AUG. 1949

MIGRATION OF SOME NORTH AMERICAN WATERFOWL

A Progress Report on an Analysis of Banding Records

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John W. Aldrich and others

Branch of Wildlife Research

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Special Scientific Report (Wildlife) No. 1

United States Department of the Interior--J. A. Krug, Secretary

Fish and Wildlife Service--Albert M. Day, Director

In cooperation with the National Wildlife Federation

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Washington, D.C.

The National Wildlife Federation contributed to this publication by paying for the printing of the maps.

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INTRODUCTION

By John W. Aldrich

The need for exact information on the migration routes of waterfowl in order to manage this group of gamebirds is obvious. By far the greatest source of information on the migration patterns of North American ducks and geese is in the Fish and Wildlife Service files of recovery records of banded birds. Much information about waterfowl migration from this source has been published from time to time, particularly in the writings of Frederick C. Lincoln. The need for a comprehensive, up-to-date compilation of this material has been increasingly apparent of late. Because of the very large volume of information contained in the bird-banding files it was deemed that the only way to make the desired information available in a reasonably short time was to divide the work among a number of Service biologists who are interested in waterfowl problems, assigning each person one or two species to work up. This was done and much information has already been organized and mapped. In most species the volume of records is so great that it has been impossible even by this concerted effort to give the entire story at this time. However, in view of the great need for the information for management, it has been decided to present the information that we have assembled in the form of this progress report. The study is continuing and other publications based on this work are expected to appear at a later date.

The information is presented in chapters by species and written by the individual who made the analysis of the banding records. The data are shown chiefly by maps, indicating actual places of banding and recovery, so that they may be of maximum use to investigators who wish to draw their own conclusions concerning the movements of waterfowl. Interpretation of the records is purposely kept to a minimum in this report since it is still an incomplete study.

One of the chief values which have resulted from the analyses to date has been the knowledge of specific weaknesses in our banding data. Armed with this information we shall be in a position to direct our banding program much more effectively toward filling these gaps in the future. It is hoped, and expected, that readers interested in waterfowl biology and management will favor us with suggestions as to what gaps appear in the information relating to their particular sphere of interest. In this way plans for further banding and the approach to the study of the records may be organized in a way to serve the greatest number of purposes possible.

The main approach to this study has been to trace the migrations of the different species between their breeding and wintering grounds.

Emphasis has been placed on the southward movement since this takes place during the time that waterfowl are being hunted and is, therefore, a very critical period in so far as their management is concerned. In making the analyses, greatest reliance has been placed on the migration patterns based on "direct recoveries" - which implies the recapture of the bird during the same migration period in which it was banded. Thus direct recoveries for the fall migration period would be from birds banded during the breeding season (June 1 to Aug. 31) or the fall migration (Sept. 1 to Dec. 31) and recovered before the next spring migration has started (Feb. 1). Conversely an indirect recovery is any recapture subsequent to the period of a direct recovery. Direct recoveries for the spring migration period would involve birds banded on their wintering grounds (Jan. 1 to Jan. 31) or during the spring migration (Feb. 1 to May 31) and recovered before June 15. Slight modifications of these periods have been made by some authors to fit special conditions. Whenever the data permitted, direct recoveries were used because they greatly increase the probability that the bird had traveled in one general direction between time of banding and time of recovery.

Unfortunately there are a number of species of waterfowl which have received little or no banding on the breeding grounds. In these cases we have had to rely on the results of banding in migration or on the wintering grounds to determine through recoveries where the breeding grounds of certain segments of the population are.

Another factor which has tended to make the information somewhat one-sided is the fact that most of the banded birds are recovered during the fall migration when most of the shooting takes place. The result has been that relatively little evidence is available as to the routes of spring migrations northward to the breeding grounds. Also, in the case of birds banded only in seasons other than the breeding season, the paucity of recoveries (other than during the hunting season) give very little information as to where the breeding grounds of those populations are actually located.

Despite these difficulties and lack of sufficient data in some cases, it is possible to see in the following chapters fairly convincing patterns of migration, as well as the regions which benefit by the migration of those species from certain breeding areas to certain wintering areas. One fact which becomes obvious immediately upon examination of the various species maps is the great variation in patterns between species. Furthermore, we notice in some species considerable diversity of directions of movements, not only of different breeding populations within species, but apparently also of different individuals of the same breeding population. A similar situation is also frequently encountered when

analysis is from the standpoint of migration from the wintering grounds. The impression is inescapable that waterfowl migration is even more complicated than we had originally supposed; that it is difficult to make generalized statements with regard to migration pathways for even a single species, let alone waterfowl in general; and that we need a great deal more information based on banding, particularly on segments of breeding and wintering populations which have not already been banded, before we can manage those populations satisfactorily. The following reports will be found to be full of unanswered questions which can be answered only by further banding in specific locations and seasons.

The term "flyway" is used in this report in two different ways. In one sense it is used to refer to a species flyway which is a rather definite migration pathway utilized by certain populations of a single waterfowl species. The term is used in another sense to refer to administrative flyways (capitalized when used with the name) which are four separate areas, the boundaries of which conform arbitrarily to state lines and which approximate as nearly as possible the regions through which major groupings of species flyways pass. The administrative flyways are distinguished to facilitate differential shooting regulations and other management practices and although related to species flyways should not be confused with them.

Symbols used consistently on the maps are a circle with a dot in the center indicating the place of banding and a single spot indicating point of recovery. In some cases lines are used to connect banding stations and points of recovery while in other cases the lines are omitted and color alone identifies the recoveries with the banding station. The impression should be avoided that lines in any way indicate the route followed by birds in going from the banding station to the point of recovery.

The maps appearing in this report for the pintail, green-winged teal, canvas-back, redhead, greater scaup, lesser scaup, and ring-necked duck were drawn by Mrs. Katheryne Tabb. Maps for all other species were drawn by the authors. Mrs. Helen Webster performed valuable service by extracting and sorting records used in these studies.

MIGRATION PATTERN IN THE MALLARD

By Arthur S. Hawkins

When mallards gather on the famous Athabaska Delta in northeastern Alberta prior to heading southward, they are a comparatively short distance from the Pacific coast wintering ground used by mallards passing through British Columbia and western Alberta. Athabaska mallards, however, do not head for the Pacific Flyway. Instead, most of them are en route to the Mississippi or Central wintering grounds over a route twice as long as the one to the Pacific.

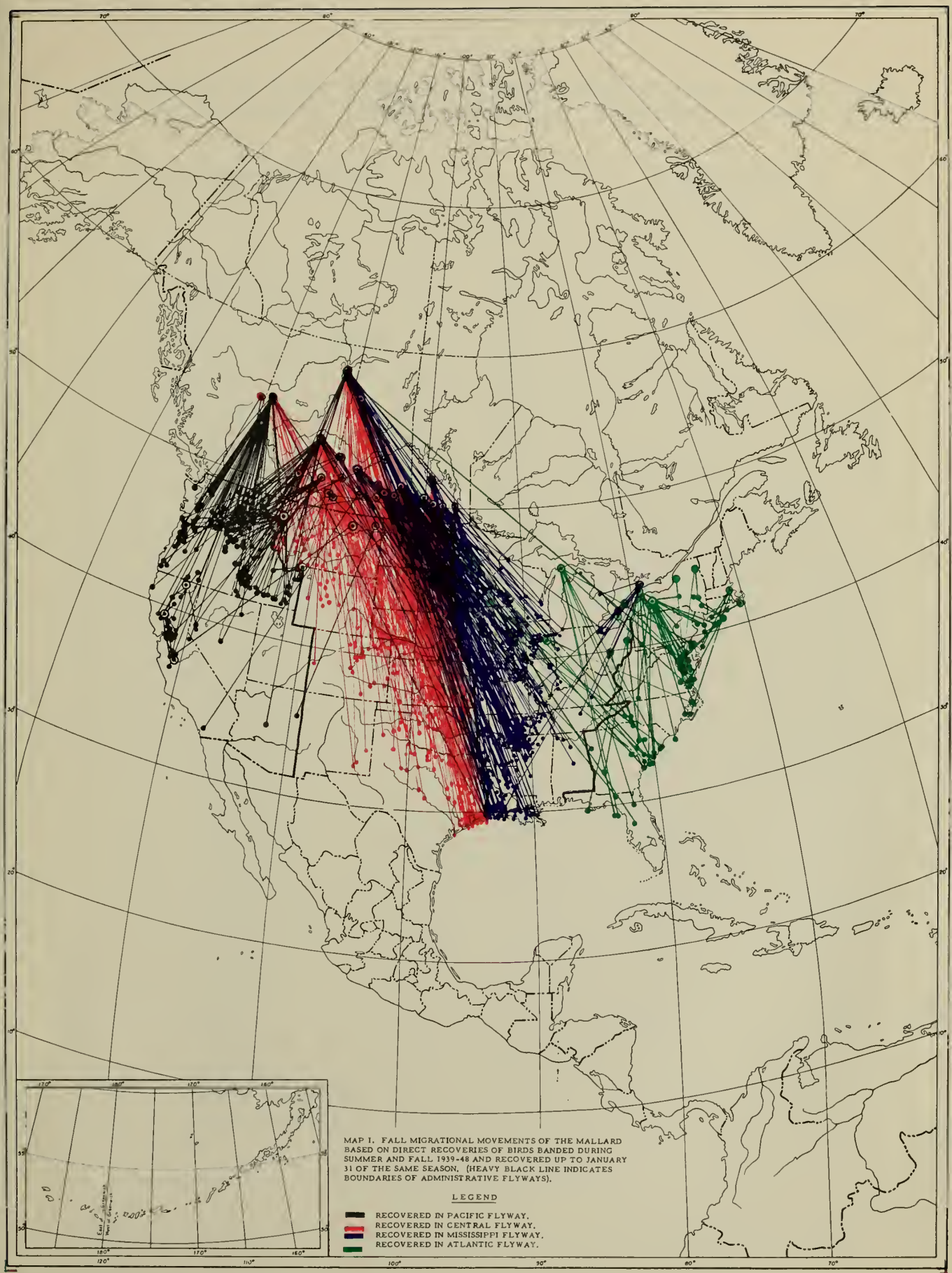
To the west across Alberta from the Athabaska is the Grand Prairie, with the Peace River linking the two localities. Despite this link and the relatively short distance involved (shorter than between Minneapolis and Madison), most of the flight through Grand Prairie uses the Pacific Flyway. In south central Alberta the flights split more or less evenly to the southeast and southwest. Draw a north-south line dividing Alberta in two equal parts, and you can predict with reasonable assurance that most mallards west of the line will head for the Pacific, while most of those east of it will cross the plains toward the Mississippi or Gulf Coast.

Another line drawn from the Athabaska Delta to the Mississippi Delta appears to be close to one of the main "beams" along which mallards navigate. Returns from mallards banded on the "beam" are distributed both east and west of it more or less evenly. Project the line northward, and it ends at the Mackenzie Delta on the Arctic coast. Extensive banding work remains to be done in the far north, however, to establish points of origin of these flights.

Returns from Saskatchewan and Manitoba banded mallards fall almost exclusively within the Central or Mississippi Flyways. Ontario-banded mallards contribute both to the Mississippi and Atlantic Flyways. Those banded in New Brunswick stayed along the Atlantic Coast.

To summarize: Most Pacific Flyway mallards pass southward through British Columbia and western Alberta. Most mallards feeding the interior flyways use a funnel-shaped path, the western side of which passes through central Alberta, and the eastern side through eastern Ontario. Most Atlantic Flyway mallards travel eastern Ontario or farther east. That appears to be the general pattern of the fall migration, indicated by the returns from Canadian bandings during the past decade (see Map 1).

The following table shows the return rate in various states and provinces from mallards banded in the prairie provincesfrom 1939-48.



MAP I. FALL MIGRATIONAL MOVEMENTS OF THE MALLARD BASED ON DIRECT RECOVERIES OF BIRDS BANDED DURING SUMMER AND FALL 1939-48 AND RECOVERED UP TO JANUARY 31 OF THE SAME SEASON. (HEAVY BLACK LINE INDICATES BOUNDARIES OF ADMINISTRATIVE FLYWAYS).

Distribution of 1,785 direct recoveries of mallards from bandings in the Prairie Provinces of Canada -- 1939-1948. (Expressed in percentages).

Place Recovered	Place Banded		
	Alberta	Saskatchewan	Manitoba
Alberta	24.0	1.0	
Saskatchewan	5.5	26.0	
Manitoba	0.5	2.0	35.0
British Columbia	1.0		
Washington	8.0	T	
Oregon	5.0	T	
California	1.0		
Idaho	4.5		
Nevada	T		
Arizona	T		
Montana	7.5	1.5	
Wyoming	1.5		
Colorado	3.0	1.0	T
New Mexico	T	T	
North Dakota	2.5	3.0	7.5
South Dakota	2.5	4.5	1.5
Nebraska	8.0	4.5	1.5
Kansas	3.0	4.5	1.0
Oklahoma	2.5	3.5	1.5
Texas	5.0	8.5	3.0
Minnesota	1.0	3.0	10.0
Iowa	2.0	5.5	5.5
Missouri	1.5	4.0	4.0
Arkansas	3.0	9.0	7.0
Louisiana	3.0	8.0	4.5
Wisconsin	0.5	0.5	2.5
Illinois	1.5	5.5	8.0
Kentucky		T	T
Tennessee		1.0	1.5
Mississippi	1.0	T	2.5
Alabama		T	T
Michigan	7.0		T
Indiana		T	1.5
Ohio		T	0.5
Maryland	T		
Florida	T		
North Carolina			T
South Carolina			T

FALL MIGRATION OF THE BLACK DUCK

By C. E. Addy

The Data

The following black duck records have been tabulated and mapped.

I. Direct recoveries from the breeding grounds to the wintering grounds or en route to the wintering grounds. This covered the years 1943-48 and 1936-40 for all important stations in operation during these periods. In addition, important bandings for the years 1923, '24, '27, '30, '33, and '41 were mapped. A total of 2734 recoveries are used in this study. Hundreds of retraps were listed but are not included in the tabulations. Fifty-seven banding stations contributed data and they operated at intervals over a period of 25 years. At the most, only 12-15 stations were in operation at the same time and there has been no effort made to coordinate banding throughout the range of the black duck.

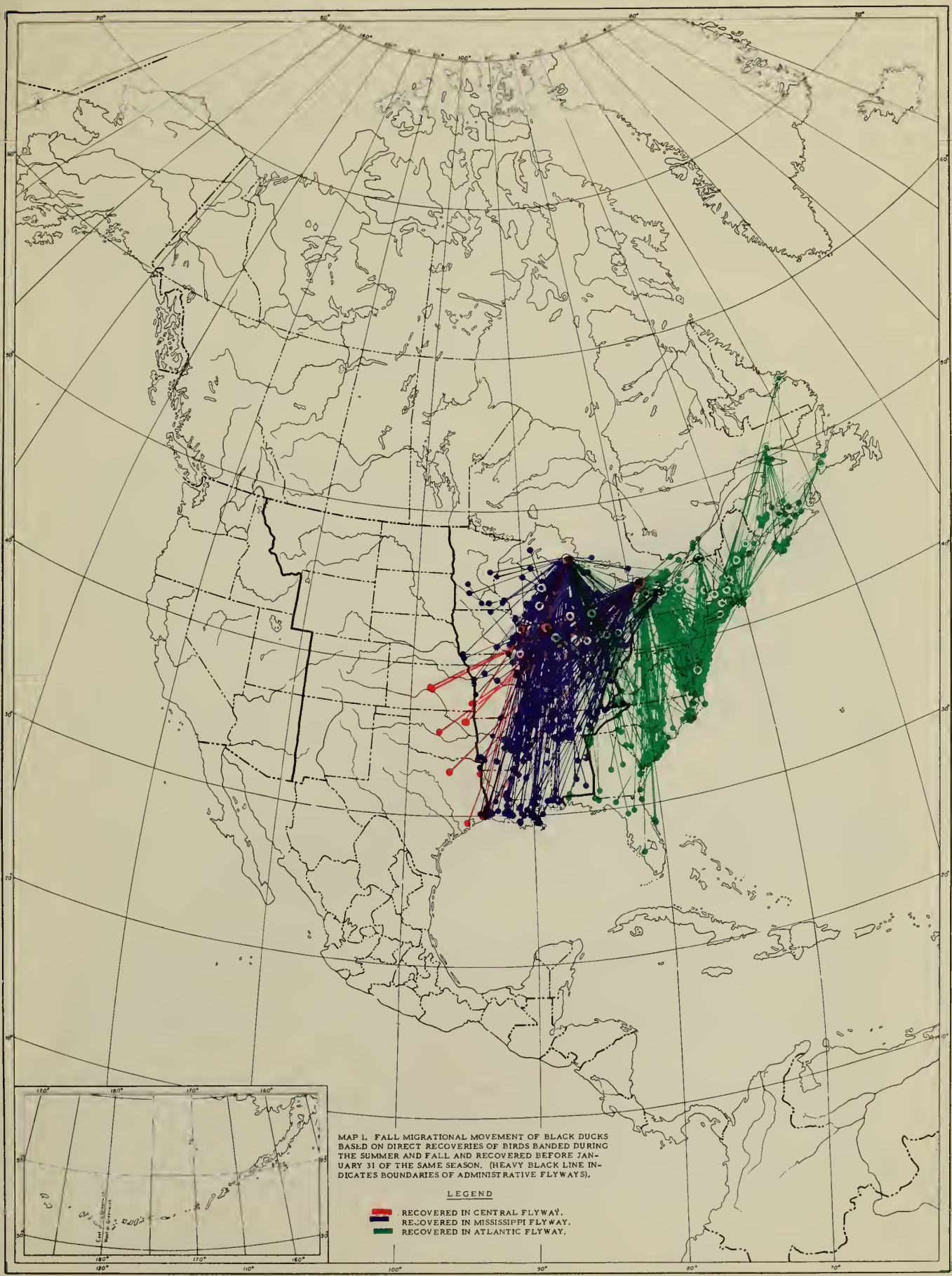
II. Indirect recoveries from birds killed in a period other than on the breeding grounds and during the southward flight in which they were banded. These covered the years 1944-47 and important bandings in 1922, '23, '24, '27, '30, '31, '33, '35, and '41. A total of 1055 recoveries are included in the tabulations used in this study. Retraps are not included.

Discussion

The tabulation of the recovery records for the black duck is far from complete, and the most that can be done in this report is to note in a very general way flight patterns, point out some of the important gaps in the data, and note some of the phases that would warrant detailed analysis.

The southward flight of the black duck is a gradual movement along many and devious routes over land and water. This movement is apparently more rapid in Canada and parts of northern United States. However, there are no rapid and long flights on a large scale as characterized by such species as the blue-winged teal.

The principal wintering grounds of the blacks raised in northeastern United States and eastern Canada is in coastal areas from northern North Carolina north. Although the majority of black ducks winter south of Cape Cod, there are undoubtedly many open winters when relatively heavy concentrations remain along the New England and Nova Scotia coasts. In addition to the principal flight of blacks coming into the Middle Atlantic States from a northeasterly direction, there is a significant number of birds that



MAP 1. FALL MIGRATIONAL MOVEMENT OF BLACK DUCKS BASED ON DIRECT RECOVERIES OF BIRDS BANDED DURING THE SUMMER AND FALL AND RECOVERED BEFORE JANUARY 31 OF THE SAME SEASON. (HEAVY BLACK LINE INDICATES BOUNDARIES OF ADMINISTRATIVE FLYWAYS).

LEGEND

RECOVERED IN CENTRAL FLYWAY.
RECOVERED IN MISSISSIPPI FLYWAY.
RECOVERED IN ATLANTIC FLYWAY.

come in from the north and northwest, passing through eastern Ontario, eastern and central New York, and eastern Pennsylvania. Banding stations at Lake Scugog, Ontario (just north of Lake Ontario), Rochester and Buffalo, New York show the fanning out of birds from these points to southeast, south, and southwest. Direct recoveries from Lake Scugog, for example, show that about 35 percent were in the Middle Atlantic States from New York to North Carolina; 15 percent in South Carolina, Georgia and Florida; and the remaining 50 percent scattered as far west and south as Michigan, Illinois, Texas, and Alabama. East of central New York the flights are predominantly toward the Middle and South Atlantic States. Birds entering the United States west of New York and Pennsylvania do not winter in any significant numbers in the Middle and North Atlantic States, but are found primarily in the Mississippi drainage basin and along the Gulf coast with a relatively small percentage terminating their flights in South Carolina, Georgia, and Florida.

Actually, it is difficult to determine the limits of any particular flight. Viewing the plotted records as a whole, one might say that there is one over-all general drifting southward. Birds from the maritimes and New England coastal areas fly in a southwesterly direction; those originating a little farther west take a more directly southward flight; those originating in the lake states and to the north fan out to the south over most of eastern United States, as far west as eastern Texas. Those west of Lake Michigan fly almost in a directly southward direction.

The physical features of the land are probably important in the location of individual routes of travel. The Appalachian Mountains probably serve to some extent to divide an east and west flight but there are a number of banding records and observations which indicate that many black ducks pass through or over these mountains.

It is difficult to evaluate the relative importance of different flights into a wintering ground for there has been little or no banding of wintering populations, particularly along the Middle and South Atlantic coasts. Banding in these areas should be started immediately and carried on over a 5 to 10-year period.

Not only is there a lack of banding on the wintering grounds, but there has been little done on the breeding grounds. The banding of breeding black ducks and their broods is difficult and costly; however, more banding stations could be in operation during late summer and early fall at the time the young and old birds flock for migration. Not only are more stations needed in the states, but there is a big, important gap in Canada.

The plotted records of indirect recoveries for the same periods of banding as above, show largely the same pattern, although there is apparently considerable mixing of birds from one season to another. Birds found along the coast one year might turn up at the same season in another year well to the west. Likewise, some western banded birds might turn up

in the east. Some birds may be well to the south in September in one year and still in the far north at the same time another year. Likewise, a bird might be in northern New England in December one year and then taken in Virginia or some other southern state a month to six weeks earlier another year.

The indirect recoveries indicate that most of the birds passing through the Lake Scugog area come from west of James Bay in Ontario. This, however, may be inaccurate since much depends on whether the chances of getting a return from Ontario and Quebec are equal. This depends to a large extent on the distribution of the human population in those remote areas.

Further and more detailed study of the records will be in order after the tabulation of the data has been completed. For instance, some bandings produced a much higher kill within a 50-mile radius of the station than was found with others. This might be due to one or a number of factors. Along the coast it may mean that the coastal marshes serve to slow up migration, or it may mean an early established local wintering population through which few if any migrants pass. There is little flight southward of birds banded south of Long Island and Cape Cod. The migrant flight is more pronounced in the case of birds banded farther north.

MIGRATION OF THE GADWALL

By G. Hortin Jensen

The gadwall is essentially a duck of the western two-thirds of the United States, occurring generally over all of the Great Plains and the intermountain valleys of the western states. Its range extends northward into southern British Columbia, the prairie provinces of Canada, thinning out at 58-60 degrees north latitude, and southward into central Mexico. There are scattered breeding populations to the eastward even at three places on the Atlantic seaboard. The main migration patterns are shown by the accompanying map of plotted recoveries of banded birds.

This study is based on 1,089 recoveries of gadwalls as follows:

	No. Recoveries	Percent
Direct recoveries of birds banded on the breeding grounds or in fall migration	652	59.9
Indirect recoveries of birds banded on the breeding grounds or in fall migration	280	25.7
Direct recoveries of birds banded on wintering grounds or in spring migration	3	0.3
Indirect recoveries of birds banded on wintering grounds or in spring migration	154	14.1
	1,089	100.0

These banding records begin in 1915 and cover the period forward to the present time. By far the greatest number of bandings have occurred during the 1930's and 40's. Banding stations have been located to give a good distribution of banding localities on the southern portion of the prairie provinces of Canada and the adjacent areas of North Dakota, South Dakota, and Montana. Three other banding stations were located in northern Alberta, while the banding stations in western United States were located in Oregon, California, and Utah.

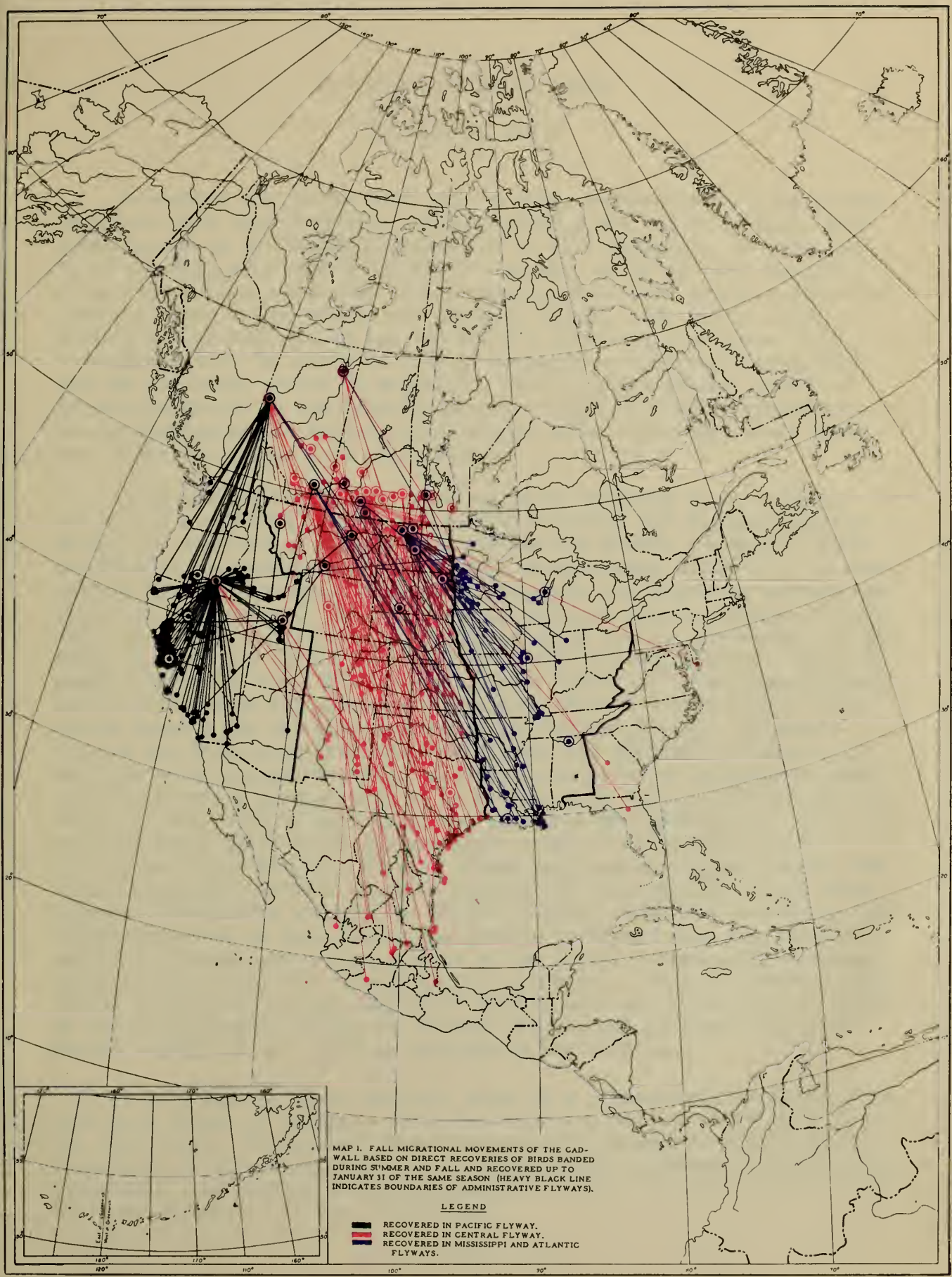
To obtain a more even distribution of recoveries over the whole of the gadwall's range, there is need for more banding stations in the western intermountain region and along the northern reaches of the range. Recent discoveries of gadwalls breeding in the eastern United States indicate need for limited banding in these localities. We may have blanks on the map because the gadwall population of this segment of the country has not as yet been banded on the breeding grounds. There is also need for banding on the wintering grounds to further delineate northward movements and locate more exactly the breeding grounds of all populations of the gadwall.

The 652 direct breeding-ground and fall migration recoveries received to date have been plotted by administrative flyways based upon the flyway in which they were recovered (see accompanying map). These recoveries were distributed by administrative flyways as follows (in this tabulation the returns from Canada and Mexico are grouped separately):

Direct Recoveries of Gadwalls Banded in Summer and Fall
Showing Region of Recovery and Region of Banding

Region	Banded		Recovered	
	No.	Percent	No.	Percent
Canada	198	30.4	63	9.6
Pacific Flyway	283	43.4	302	46.4
Central Flyway	161	24.7	188	28.8
Mississippi Flyway	10	1.5	84	12.9
Atlantic Flyway	0	0.0	3	0.5
Mexico	0	0.0	12	1.8
Total	652	100.0	652	100.0

Thus, we see from these analyses that for the gadwall there are two principal routes of migration: (1) From the Canadian prairie provinces through the Great Plains south to the wintering grounds of the Gulf coast and Mexico; (2) from Canada and intermountain breeding grounds through the far western states to the central valleys of California.



MAP 1. FALL MIGRATIONAL MOVEMENTS OF THE CADWALL BASED ON DIRECT RECOVERIES OF BIRDS BANDED DURING SUMMER AND FALL AND RECOVERED UP TO JANUARY 31 OF THE SAME SEASON (HEAVY BLACK LINE INDICATES BOUNDARIES OF ADMINISTRATIVE FLYWAYS).

LEGEND

RECOVERED IN PACIFIC FLYWAY.
RECOVERED IN CENTRAL FLYWAY.
RECOVERED IN MISSISSIPPI AND ATLANTIC FLYWAYS.

MIGRATION OF THE BALDPATE

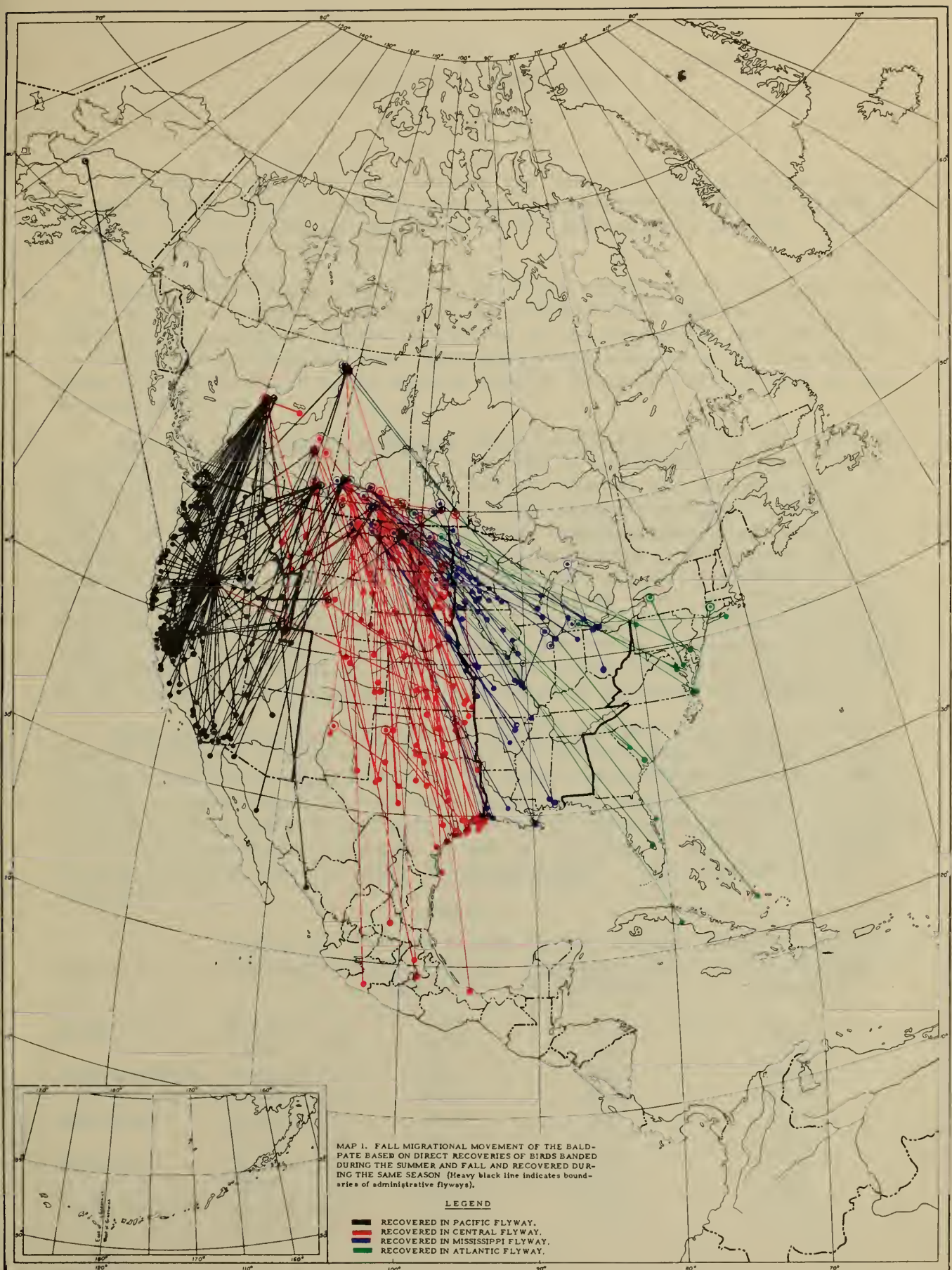
By Allen G. Smith

Throughout the period from 1923 to 1948, recoveries of 1,934 banded baldpates have been reported. Of this total 1,370, or 71 percent, were birds banded on the breeding grounds or in fall migration, of which 789, or 41 percent, were direct recoveries and 581, or 30 percent, were indirect recoveries. Bandings of this species have been widely distributed throughout the United States and southern Canada, with accent on the western and central states and the prairie provinces of Canada. This corresponds with the areas of densest breeding or wintering populations and the principal routes of migration. Though a far greater number of recoveries should be available to give the entire picture, especially from wintering-ground banded birds, we may still learn much about baldpate migration routes from data at hand.

It is interesting to note that baldpates breeding in our western states and in western Alberta and British Columbia are recovered mainly within the confines of what we call the Pacific Flyway. However, birds breeding in the central northern states, Saskatchewan, Manitoba, and even eastern Alberta are found to scatter throughout the remaining eastern two-thirds of the country. Thus, we see one distinct Pacific baldpate flyway and a widespread interior baldpate flyway which carries its members to the Atlantic coast and beyond into the West Indies and the Bahamas. Based on samples banded so far, the greatest flights appear to be southward through the Pacific States and intermountain areas, while a second heavy flight occurs through the interior portion of the Central Flyway. Movements through the Mississippi and Atlantic Flyways are diagonal offshoots of a major interior migration route. Indirect recoveries of baldpates banded on their breeding grounds show no variations from this pattern except in so far as they tend to accentuate the vast area included in the baldpate's breeding range which feeds the migration routes that converge in our Pacific and Rocky Mountain States. Breeding areas throughout Alaska, the Yukon, Mackenzie, British Columbia and western Alberta, all funnel their baldpate populations through the Pacific Flyway. Indirect recoveries from baldpates banded on their wintering-grounds in Kansas show a northward migration through the western plains to the breeding areas of our central northern states and the eastern prairie provinces. Three of these records extend into Alaska and the Northwest Territories, but apparently the bulk of these populations, migrating through the central part of the United States, remain in the interior portions of the continent.

As with several other species, there is a pronounced indication of an east-west flight of baldpates from the northern breeding areas of Utah to the west coast. Though many more records are necessary to establish the importance of this migration route, nevertheless it appears so consistently year after year in both direct and indirect recoveries as to warrant its being considered as of some importance.

Thus far the bulk of recoveries for the baldpate have been from birds banded in Oregon, California, Utah, Montana, North and South Dakota and Kansas. Increased bandings in the future in other states will help to fill in the gaps in our present knowledge of the movements of various populations along the major baldpate flyways.



MAP 1. FALL MIGRATIONAL MOVEMENT OF THE BALDPATE BASED ON DIRECT RECOVERIES OF BIRDS BANDED DURING THE SUMMER AND FALL AND RECOVERED DURING THE SAME SEASON (Heavy black line indicates boundaries of administrative flyways).

LEGEND

- RECOVERED IN PACIFIC FLYWAY.
- RECOVERED IN CENTRAL FLYWAY.
- RECOVERED IN MISSISSIPPI FLYWAY.
- RECOVERED IN ATLANTIC FLYWAY.

THE MIGRATION OF THE PINTAIL

By Seth H. Low

The maps, table, and this summary are based on the preliminary study of some 30,000 returns from the banding of approximately 175,000 pintails in North America since the inception of the bird-banding program. Tentative conclusions are as follows:

Pacific Northwest.--Banding in the Puget Sound region indicates that this region is a major wintering ground rather than a way station of a major flight, since less than 10 percent of the recoveries are from south of the Washington-Oregon line. This population appears to be distinct from other populations which migrate through the other states west of the Mississippi River.

West of the Mississippi River.--West of the Mississippi there are substantial populations which winter primarily in California, Mexico, Texas, and Louisiana and to some extent in Central America and northern South America. Although a large portion of these presumably migrate back and forth via the same route, the evidence now suggests that a substantial portion of the pintail population makes a round-robin, counter-clockwise migration involving more than one flyway. This flight originates in the breeding grounds; moves southward via the prairie provinces, Montana, and North Dakota; swings westward into California; continues south into Mexico; crosses over to the Gulf coast; and returns north in the spring up through the Central and Mississippi Flyways. This flight passes through California in the early fall and reaches the Gulf coast in November and December.

Data pertaining to "Round-Robin" migration.--Map 1 and Table 1 are graphic attempts to size up the portion of pintails migrating south from the Northern Plains region via each of three administrative flyways. Three regions of about equal area and with about equal hunting pressure (as indicated by duck stamp sales) were selected to represent the Pacific, Central and Mississippi Flyways as shown in map 1: Pacific - California; Central- Nebraska, Kansas, and Oklahoma; and Mississippi - Iowa, Missouri, and Arkansas.

TABLE 1

Banded in:	Number of Recoveries:	Pacific Flyway (California) (Percent)	Central Flyway (Neb-Kans-Okla) (Percent)	Mississippi Flyway (Iowa-Mo-Ark) (Percent)
ALBERTA:	Direct: 100	77.0	12.0	11.0
	Total 165	82.4	9.1	8.5
SASKATCHEWAN:	Direct: 50	58.0	28.0	14.0
	Total 77	68.8	20.8	10.4
MANITOBA:	Direct: 17	35.3	47.0	17.7
	Total 32	50.0	31.3	18.7
MONTANA:	Direct: 39	33.3	30.8	35.9
	Total 59	50.8	23.7	25.5
NORTH DAKOTA:	Direct: 131	11.5	53.4	35.1
	Total 186	23.1	44.6	32.3

Each of these regions is far enough south and still far enough north to eliminate doubt as to which flyway the birds were actually traveling in. It cannot be assumed that all of these birds represent breeding birds of the Northern Plains. Some undoubtedly breed there while others were migrants from farther north.

Two points of significance are to be noted. The first is apparent from a comparison with the maps for some other species of ducks. Some of the species show a definite trend from Alberta to the Pacific Flyway but the farther east the banding station is located the more the trend is south and southeast. For most other species, even from Saskatchewan, the trend is south and southeast, and from Manitoba and North Dakota is exclusively south and southeast. The Table indicates that the pintail does not conform to this pattern but shows a strong trend to the Pacific even from as far east as Manitoba and North Dakota.

The second point of significance is revealed by comparison of the total recoveries with the direct recoveries. When the indirect recoveries are added to the direct recoveries, the percentage from the Pacific Flyway rises in every case at the expense of the other two flyways. Direct fall recoveries include both young birds of the year and adults, but indirect recoveries are adult birds when killed. Thus, the first conclusion is that adult birds are more likely to be killed in the Pacific Flyway than in the other two flyways. This could not be explained on the basis of the birds migrating back and forth in the same flyway every year. However, there is a plausible explanation if it is assumed that, while the young migrate south with the same scatter-gun dispersal as is characteristic of some other species of ducks, the adults tend to make a round-robin, counter-clockwise migration. The first year pintails would be exposed to hunting in all flyways but in subsequent years would be exposed to hunting while moving south via California in the fall but protected in the spring while returning north via the Central and Mississippi Flyways. Another explanation might be that adults and young migrate at different times and that the young may pass through California before the hunting season.

In Oregon almost all the banding has been done on the Malheur National Wildlife Refuge in the southeastern portion of the State. The recoveries indicate a heavy flight into California where about half of the recoveries were taken. However, there are a noticeable number of direct recoveries from Mexico, Texas, and Louisiana.

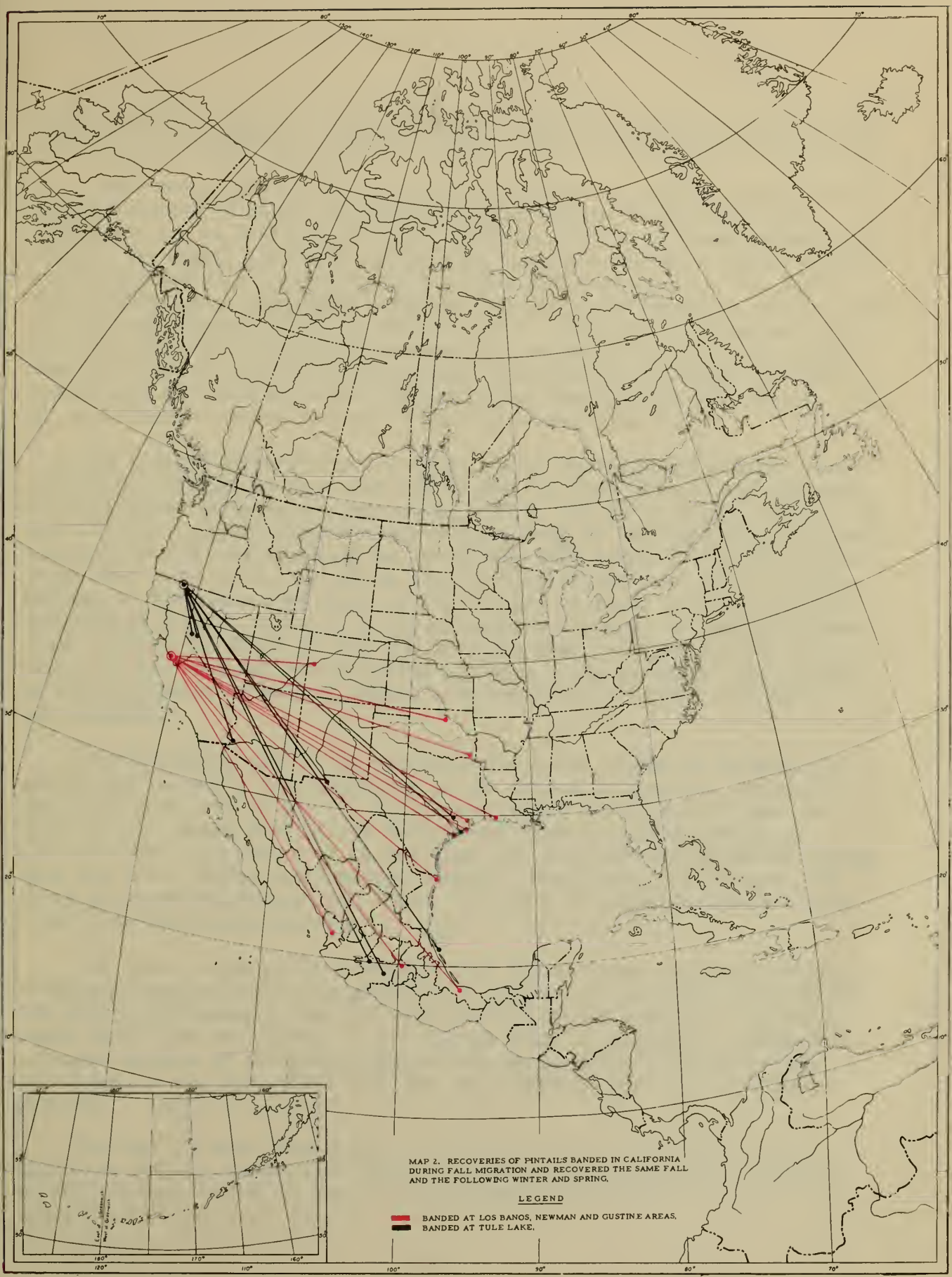
Approximately 875 return cards are on file for pintails banded in Utah, mostly in the vicinity of Great Salt Lake. Most of the banding was during August and September with some in July and October. Of the recoveries approximately 45 percent were retaken in Utah, 20 percent in California, 5 percent in Mexico, 10 percent in Texas, 5 percent in Alaska and Canada, and 15 percent scattered through the other states west of the Mississippi River.

A trend to the Gulf Coast is to be noted for both the Oregon and Utah

MAP I. DISTRIBUTION OF PINTAIL BANDED IN SASKATCHEWAN BETWEEN THE PACIFIC, CENTRAL AND MISSISSIPPI FLYWAYS BASED ON THE PERCENTAGE OF TOTAL DIRECT RECOVERIES IN COMPARABLE SAMPLE AREAS IN EACH FLYWAY.

LEGEND

PERCENT OF TOTAL RECOVERED IN PACIFIC FLYWAY.
PERCENT OF TOTAL RECOVERED IN CENTRAL FLYWAY.
PERCENT OF TOTAL RECOVERED IN MISSISSIPPI FLYWAY.



MAP 2. RECOVERIES OF PINTAILS BANDED IN CALIFORNIA DURING FALL MIGRATION AND RECOVERED THE SAME FALL AND THE FOLLOWING WINTER AND SPRING.

LEGEND

BANDED AT LOS BANOS, NEWMAN AND GUSTINE AREAS.
BANDED AT TULE LAKE.

banded pintails, but in neither case can it be stated whether these birds went directly southeast to Texas or swung around via California and Mexico.

Facts which have tended to reduce the amount of pertinent data bearing on the movement of birds which pass from California to Mexico and the Gulf Coast are as follows: (1) In California most of the banding has been done in the winter and early spring and, therefore, pertains to the wintering populations; (2) insufficient attention has been given to the early fall flights which presumably would contain the birds which go on into Mexico; (3) hunting pressure is low in Mexico; (4) a difference in languages interferes with the reporting of recoveries from Mexico; (5) recent hunting seasons in the United States have ended on or before January 8, with the result that few recoveries are obtained after the close of the season. All of these factors should be kept in mind in considering Map 2.

Map 2 shows 20 recoveries of birds banded during July, August, September, and October at Tule Lake and in the Los Banos-Newman-Gustine area of California and taken the same fall, winter, and early spring outside of that State. California recoveries of this group of bandings are not shown although they far outnumbered the recoveries from south of that State, because they would in no way add to the solution of the problem of what percentage of these birds go south of California; in fact, they would obscure the picture because there is no way of knowing how many of them would have gone south of the State if they had not been shot. The recoveries show that at least some California-banded pintails occur in central Mexico and on the Gulf coast of Mexico, Texas, and Louisiana in October, November, and December.

In considering all of the recoveries of birds banded in California, direct and indirect, and regardless of the season of banding, the following facts have been noted: (1) California-banded pintails have been retaken in all states west of the Mississippi River except New Mexico; (2) more have been recovered in the aggregate from Alberta and Saskatchewan than the total number from British Columbia, Washington, and Oregon; (3) there are more recoveries from Alaska than from any other geographic unit other than California itself.

The above considerations suggest that while Alaska is the principal nesting ground of California pintails, a portion of the birds are reared in the prairie provinces; also that some portion of the Alaskan birds which reach California may migrate south via the prairie provinces. Furthermore, a larger portion of the early migrants may go on south into Mexico and cross over to the Gulf coast than has been shown so far by the banding records.

The banding data from Kansas are typical for the northward spring migration through the Central Flyway. From the large number of pintails which have been banded in Kansas during February and March, slightly over 1,000 recoveries are on file.

Map 3 shows the distribution of 400 recoveries of Kansas banded pintails during the fall immediately following the spring in which they were banded. The figures are the percentages of the total recoveries (400) in each geographic unit and crosses represent one-half of 1 percent or less.

It will be noted that the largest percentage is 25 percent for Texas and the next largest is 14 percent for California. The figures show that almost twice as many Kansas banded pintails were taken in California as in any other state except Texas. This definitely indicates that some pintails which use the Central Flyway in the spring migrate to the Pacific Flyway the following fall. If, as this evidence and the preceding considerations seem to indicate, pintails proceed south to Texas via both the Pacific Flyway and the Central Flyway, then it is readily apparent why the largest numbers are killed in Texas.

East of the Mississippi River.--There is a small but regular drift of pintails from the northern plains region to the Atlantic coast, Florida, and Cuba. East of the Mississippi this drift is more pronounced. Most of the birds either go to the Gulf or to the Atlantic coast. Pintails from the interior rarely reach New York or the New England States but occur mostly from New Jersey south into the West Indies.

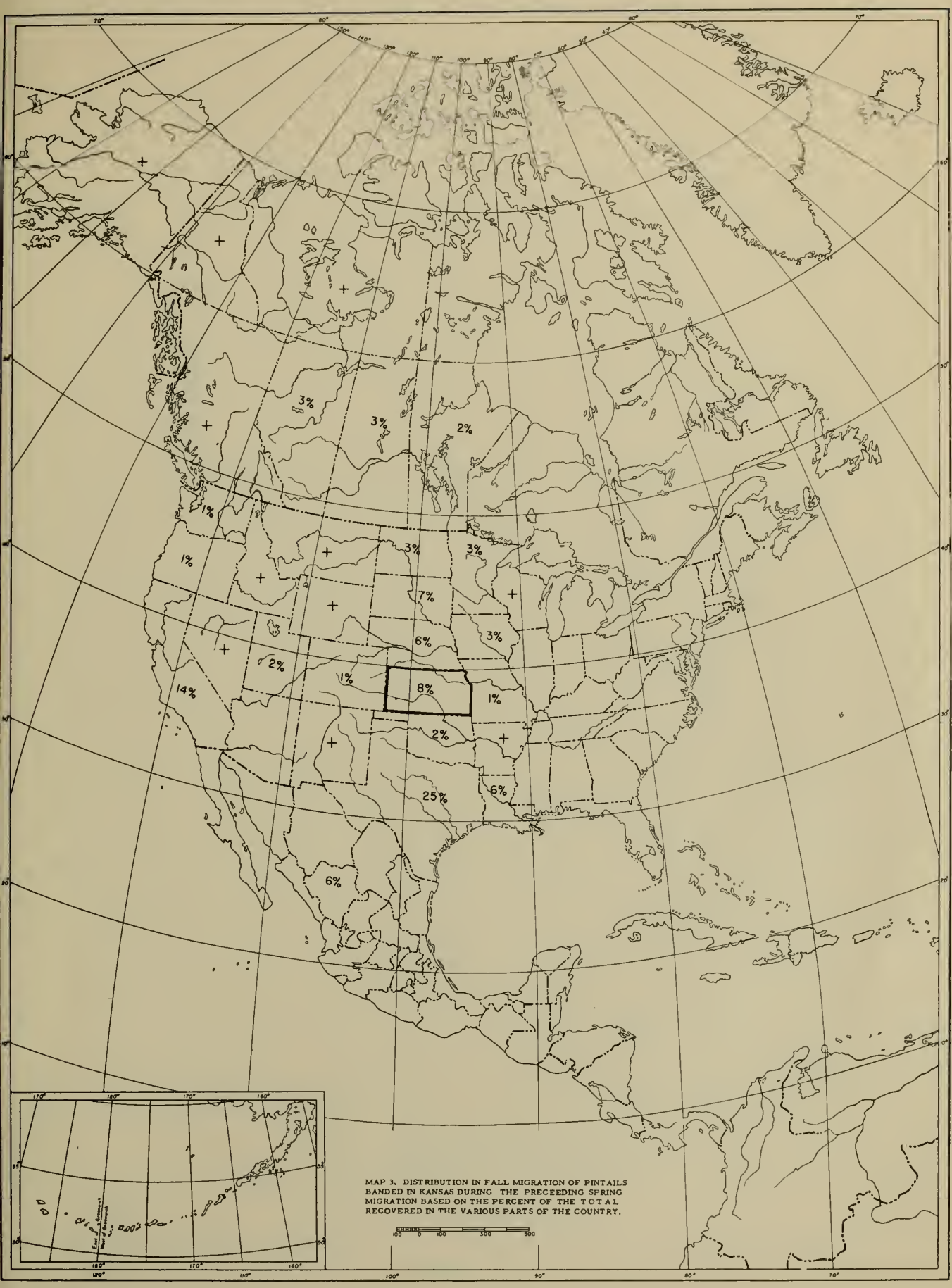
Pintails have been banded and/or retaken in almost every state and province east of the Mississippi but the numbers involved are insufficient as yet to reveal clear and complete patterns of movements. However, recent direct recoveries (Map 4) do reveal an interesting pattern for pintails banded in the maritime areas of Labrador, Quebec, New Brunswick, and Newfoundland. One flight is down the Atlantic Coast and the other is up the St. Lawrence River and westward through the Great Lakes; but data on the latter flight are incomplete as it is not evident where these birds winter or how they return to their breeding grounds.

Isolated records of interest.--Three recoveries warrant special mention as follows:

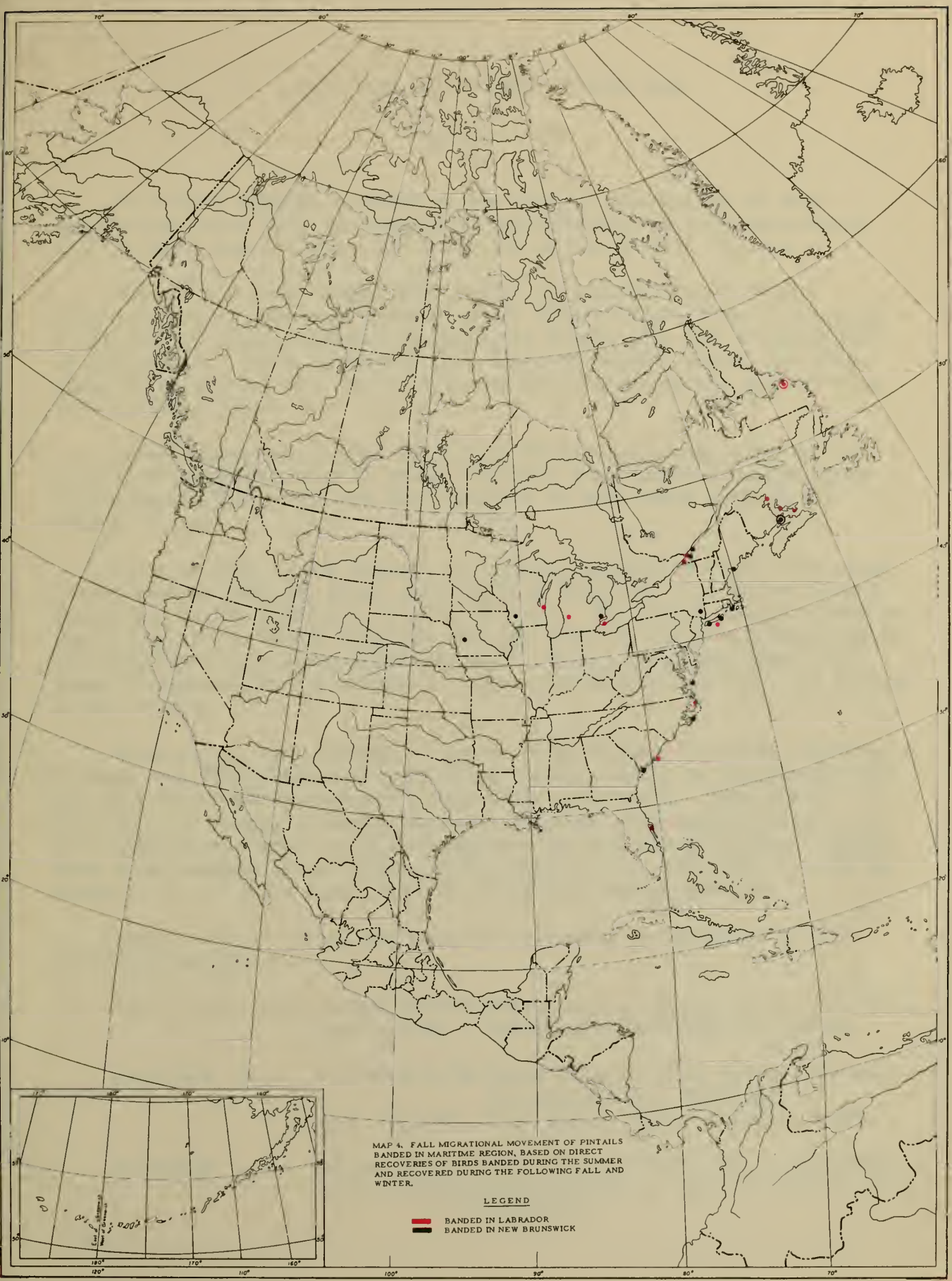
40-693910 - M banded 8/15/42 Bear River Bird Refuge, Brigham, UTAH
found 11/5/42 Palmyra Island, Territory of Hawaii SOUTH PACIFIC.

V-4720 J M banded 6/30/30 Adaldal near Husiak, northern ICELAND
shot 5/1/32 near Bradore Bay, Saguenay Co., QUEBEC.

48-620729 I M banded 8/19/48 Tinker Harbor, Hamilton Inlet, LABRADOR
shot 9/15/48 on the River Dart between Totnes and Dartmouth, southern ENGLAND.



MAP 3. DISTRIBUTION IN FALL MIGRATION OF PINTAILS BANDED IN KANSAS DURING THE PRECEEDING SPRING MIGRATION BASED ON THE PERCENT OF THE TOTAL RECOVERED IN THE VARIOUS PARTS OF THE COUNTRY.



MAP 4. FALL MIGRATIONAL MOVEMENT OF PINTAILS BANDED IN MARITIME REGION, BASED ON DIRECT RECOVERIES OF BIRDS BANDED DURING THE SUMMER AND RECOVERED DURING THE FOLLOWING FALL AND WINTER.

LEGEND

BANDED IN LABRADOR
BANDED IN NEW BRUNSWICK

MIGRATION OF THE GREEN-WINGED TEAL

By Seth H. Low

This brief summary is based on the partial examination of some 3,190 return cards from the banding of approximately 46,500 green-winged teal in North America since the inception of the banding program.

Most of the green-winged teal banded in southwestern British Columbia (Map 1) have been retaken in the same province with a sprinkling of recoveries south through Washington and Oregon into the northern half of California. A few birds have been taken in Nevada, Idaho, and Utah. Indirect recoveries (not shown) indicate that Alaska is the main nesting area of these ducks.

Green-winged teal banded in eastern British Columbia, Alberta, and western Saskatchewan (Map 2) show a tendency for a portion of the birds to migrate to California and for a portion to move south through the Central Flyway.

There are nearly 600 direct and indirect recoveries from green-wings banded in Utah (Map 3). About one-fourth of these are from Merced County, California or the immediate vicinity thereof. The almost complete lack of recoveries (4) in Nevada suggests that the teal fly non-stop across Nevada. This population shuns the northwest (B.C., Wash., Oreg., and Idaho) but shows a tendency for individuals to appear in the other Pacific and Central Flyway states.

Green-winged teal banded in eastern Saskatchewan, Manitoba, eastern Montana, and North Dakota (Map 2) stick fairly closely to the Central Flyway, although a few individuals have gone to California. Birds from Wisconsin, Michigan, Illinois, Indiana, and Ohio (not mapped) move south and southwesterly down the Mississippi and Central Flyway states. Unlike some other species of waterfowl, there appears to be very little drift of birds to the Atlantic coast from the interior breeding grounds.

Individuals, however, may accidentally stray as indicated by the following records:

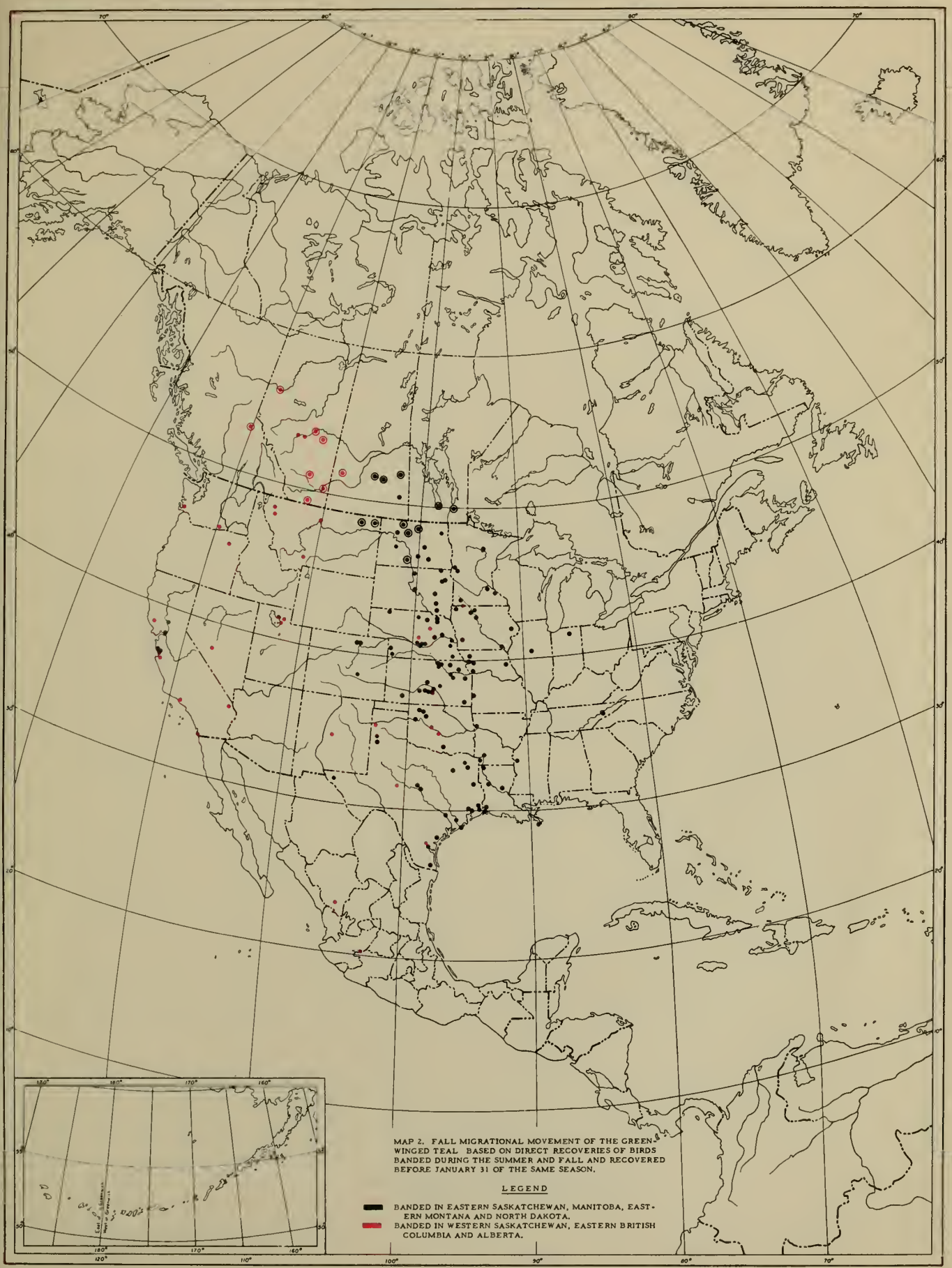
ABBA 22286 A Male	banded 3/18/18	Cayuga Lake, Cayuga County, NEW YORK;
	shot 1/7/24	Caddo Lake, Harrison Co., TEXAS.
38-517339 J -	banded 8/11/38	Seney Nat. Wildlife Refuge, Germfask, Schoolcraft Co., MICHIGAN;
	shot 10/3/38	Saco River, Saco, York Co., MAINE.
40-520418 - -	banded 9/26/40	Tulare Lake, Tulare Co., CALIFORNIA;
	shot 6/10/43	Henley Harbour, Straits of Belle Isle, LABRADOR.

38-523105 J - banded 7/16/46 Alton, Penobscot Co., MAINE
"found" 10/5/46 Poygan, Winnebago Co., WISCONSIN.

It should also be noted that from a total of 136 recoveries from Kansas banded green-wings, 11 (8 percent) have been taken in California. Of these, 10 out of the 11 were banded in the spring. This may possibly indicate a rotary route of part of the population similar to that postulated for the pintail.

Most of the recoveries of birds banded in the Maritime Provinces (Map 1) have been along the Atlantic coast, mostly from Massachusetts to Virginia, with one in Florida. Of three birds banded in the early fall at Baie Johan Betz, Saguenay County, Quebec, two were retaken later the same fall further up the St. Lawrence River and one at Council Bluffs, Iowa; and one banded in Newfoundland was retaken in Louisiana.

GREEN-WINGED TEAL
MAP 1. FALL MIGRATIONAL MOVEMENT OF THE GREEN-WINGED TEAL BASED ON DIRECT RETURNS OF BIRDS BANDED DURING THE SUMMER AND FALL AND RECOVERED BEFORE JANUARY 31 OF THE SAME SEASON.
LEGEND
BANDED IN SOUTHWESTERN BRITISH COLUMBIA.
BANDED IN MARITIME PROVINCES.


MAP 2. FALL MIGRATIONAL MOVEMENT OF THE GREEN-WINGED TEAL BASED ON DIRECT RECOVERIES OF BIRDS BANDED DURING THE SUMMER AND FALL AND RECOVERED BEFORE JANUARY 31 OF THE SAME SEASON.
LEGEND
BANDED IN EASTERN SASKATCHEWAN, MANITOBA, EASTERN MONTANA AND NORTH DAKOTA.
BANDED IN WESTERN SASKATCHEWAN, EASTERN BRITISH COLUMBIA AND ALBERTA.

MAP 3. MIGRATIONAL MOVEMENT OF GREEN-WINGED TEALS BANDED AT GREAT SALT LAKE, UTAH.

MIGRATION OF THE BLUE-WINGED TEAL

By Jerome H. Stoudt

Nearly 3000 recoveries of banded blue-winged teal, dating back to 1920, were examined in this study. The percentage of blue-wings recovered is much smaller than in most species of waterfowl, due to the fact that many of these ducks move southward ahead of the open hunting seasons in the United States and have left the country before much hunting pressure is exerted upon them. This has been especially true the past three hunting seasons when opening day in the northern part of the country was after October 1. Banding recoveries indicate that a much larger percentage of blue-winged teal were killed previous to 1946. The substantial increase in this species during the past three seasons has also borne out this fact.

The general migration pattern of the blue-winged teal from the breeding grounds is from the northwest to the southeast with a very small percentage moving straight southward or in a southwesterly direction. The accompanying maps illustrate the main migration routes, and Map 2 shows percentages of recoveries by states and provinces. It is possible to draw a weighted curve from each general breeding area using recovery percentages to indicate the actual route followed. When these data are correlated with other observational data it will be possible to define an exact "species flyway" for the blue-winged teal. For all practical purposes the blue-winged teal raised in the Canadian prairie provinces and the central northern states migrate southward through the following states:

Outer Edge of Pathway (Western)	Main Arterial Route	Outer Edge of Pathway (Eastern)
Central Montana Wyoming Colorado West Texas	E. Montana to Wisconsin South Dakota to Illinois Nebraska to Missouri Kansas and Oklahoma to Mississippi Texas to western Florida	Atlantic Coast from Quebec and the New England States down to eastern Florida.

Probably the main arterial route could be still further narrowed down to include only the States of North and South Dakota, Minnesota, Iowa, Missouri, and Louisiana. These States hold the bulk of the birds moving southward.

The main concentration point for the blue-wings which migrate south of the United States seems to be along the coast of Louisiana. From here they apparently fly to southeastern Mexico, Central America, the West Indies and to South America.

Of 1,045 direct recoveries 114 were from south of the border of the United States. These were birds which were banded on the breeding grounds and killed the same fall or winter. Of the 114:

50	percent	were	recovered	in South America
25	"	"	"	" Cuba and the West Indies
14	"	"	"	" Central America
11	"	"	"	" Mexico

This may not necessarily mean that more blue-wings migrate to South America. It may be that hunting pressure is higher there. However, the preponderance of recoveries in South America seems to indicate a very substantial movement of the blue-wing population to that continent.

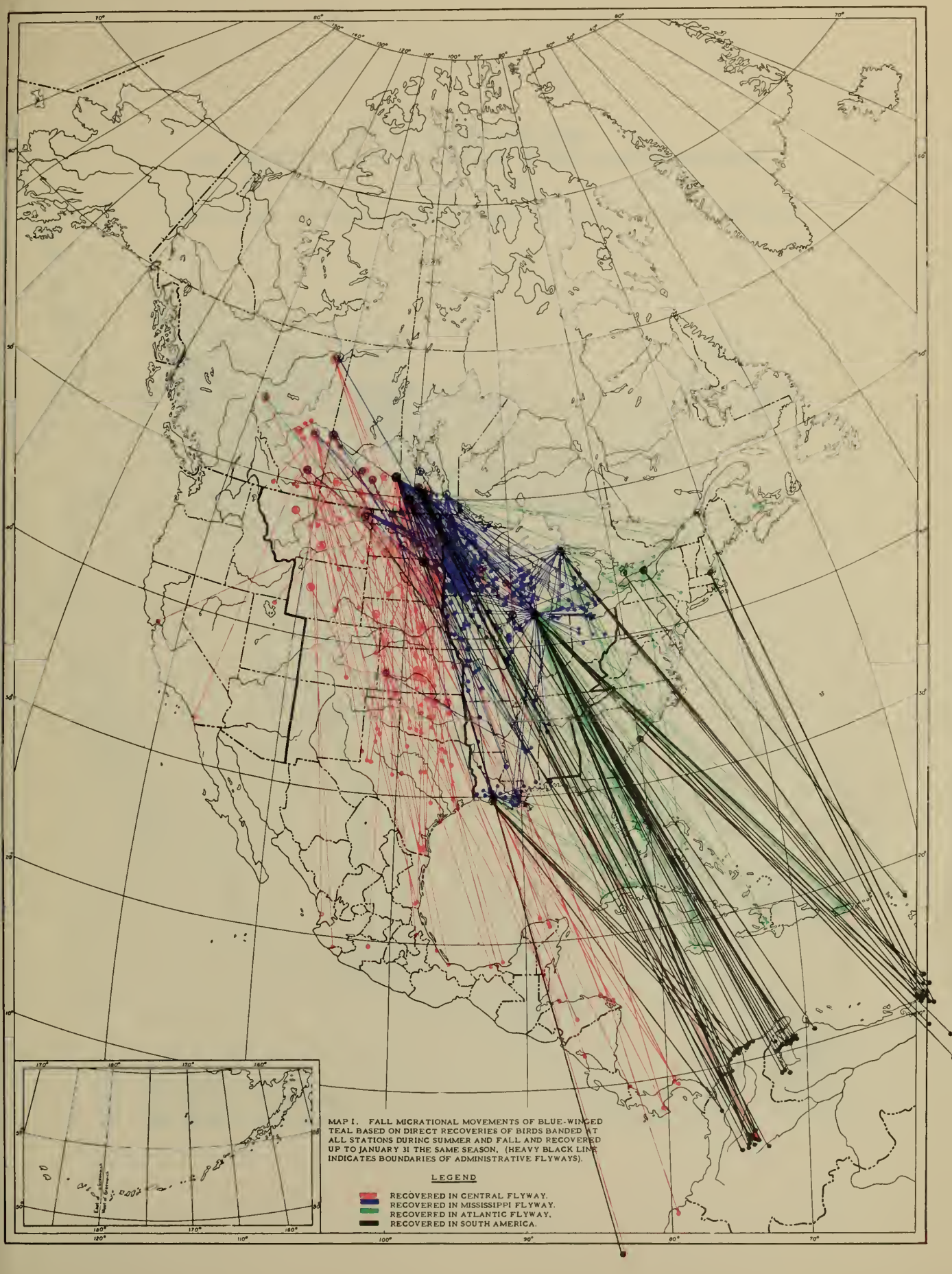
As in other species, there are apparently segments of the blue-wing population which do not follow the general pattern of migration. There appears to be an early movement of these teal into the Orland Park area near Chicago. From banding returns we find that these same birds move northwestward and northeastward for several hundred miles before finally departing for the wintering grounds. This may be a gradual movement out farther each day in search of better feeding grounds. About six percent of the recoveries from birds banded in the Chicago area were recovered in Minnesota the same fall as they were banded.

There are also segments of the blue-wing population which in the past, at least, have wintered in the United States every year. Of 83 recoveries from birds banded in South Carolina during the winter only one was taken south of that State and that in South America. Fifty percent were taken right back near the banding station in subsequent years.

The longest flight recorded was one of over 4,000 miles made by an adult male blue-wing which was banded at Oak Lake, Manitoba, during the first week of September and recovered near Lima, Peru, South America, during the latter part of January. Records of flights of over 2,500 miles are common.

Probably the fastest flight over a long distance was one made by a juvenile male which traveled 3,800 miles from the Athabaska Delta in Alberta, Canada to Maracaibo, Venezuela in exactly one month, from the second week in September to the second week in October. This was an average of 125 miles per day! Quite a few blue-wings covered from 2,300 to 3,000 miles in a 30-day period but the majority were not recovered in South America until 2 or 3 months after they were banded.

It is hoped that future banding will give us a better clue to the effect of hunting pressure on this species, and also any difference which may exist between age groups.

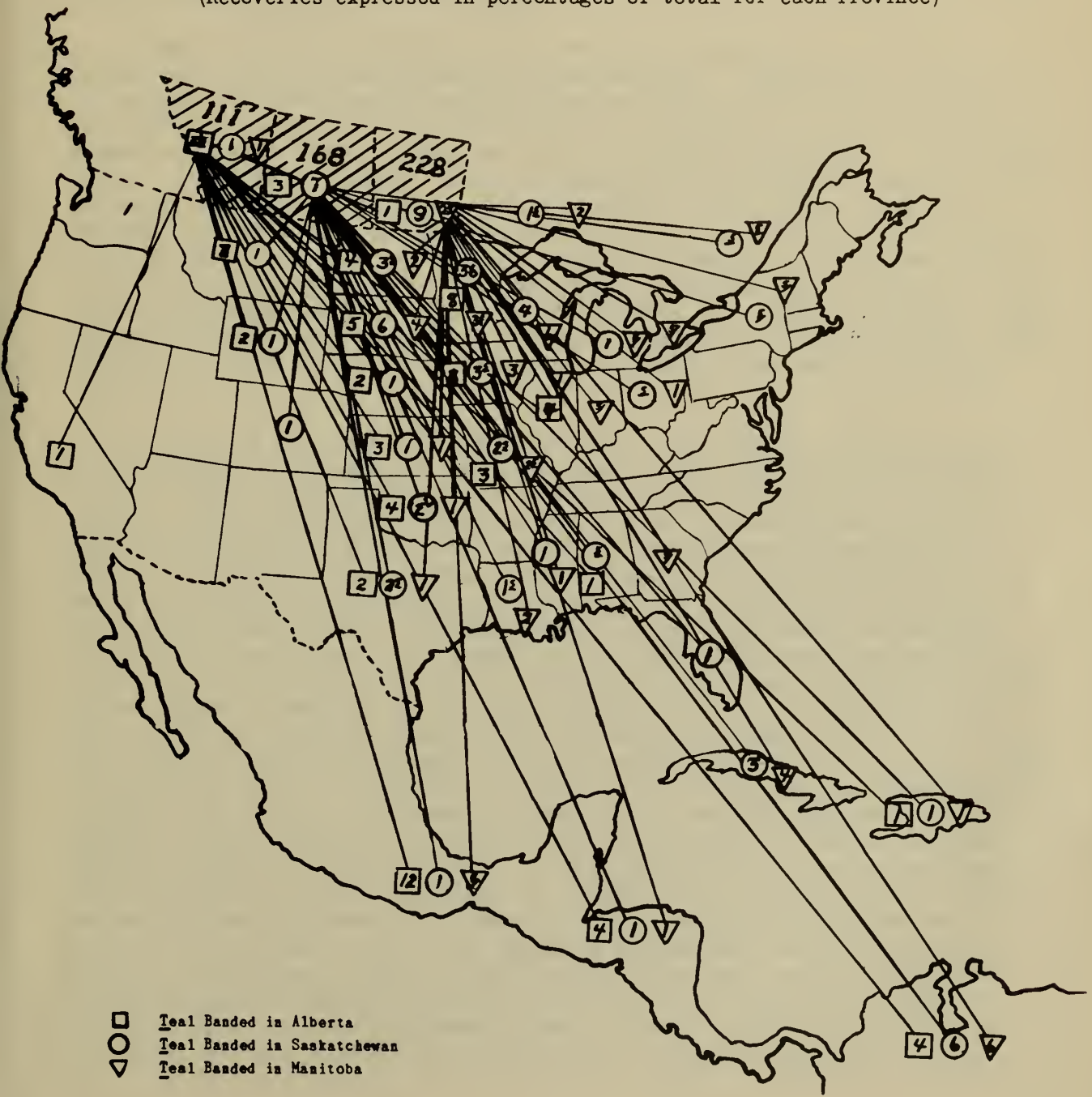

MAP I. FALL MIGRATIONAL MOVEMENTS OF BLUE-WINGED TEAL BASED ON DIRECT RECOVERIES OF BIRDS BANDED AT ALL STATIONS DURING SUMMER AND FALL AND RECOVERED UP TO JANUARY 31 THE SAME SEASON. (HEAVY BLACK LINE INDICATES BOUNDARIES OF ADMINISTRATIVE FLYWAYS).
LEGEND
RECOVERED IN CENTRAL FLYWAY.
RECOVERED IN MISSISSIPPI FLYWAY.
RECOVERED IN ATLANTIC FLYWAY.
RECOVERED IN SOUTH AMERICA.

Map 2. BLUE-WINGED TEAL

507 RECOVERIES FROM TEAL BANDED IN THE CANADIAN PROVINCES

1920 - 1948

(Recoveries expressed in percentages of total for each Province)



MIGRATION OF THE CINNAMON TEAL

By G. Hortin Jensen and Allen G. Smith

The normal range of the cinnamon teal is restricted in North America to the western part of the continent.

Over a period of 32 years relatively few cinnamon teal have been banded and only 138 recoveries have been received. Eighty-four, or about 61 percent, of these were direct recoveries from birds banded on the breeding grounds. Aside from one recovery of a bird banded in Saskatchewan, all direct recoveries of this species have been from birds banded in the United States. To further confine the locations of these bandings, they have all occurred in either California, Oregon, or Utah. Of all known direct recoveries in the United States, only three have been recovered east of the Continental Divide: one in Colorado and two in Texas. Another weakness in the banding data relating to this species is that 62, or 73 percent, of all direct recoveries were at or within 50 miles of the banding stations. This leaves only 22 direct recoveries for the cinnamon teal far enough away from the banding station to aid in determining migration routes to wintering areas.

From these 22 recoveries, two patterns of migration are indicated. First, we have a movement of the birds within the central valley of California. These populations appear to remain within the State or to move into northern and central Mexico in the winter. Cinnamon teal banded in Oregon and Utah also show a movement in a southeasterly direction into Mexico and South America, probably through the intermountain valleys. There is a second pattern indicated by direct recoveries which may prove to be representative of a sizeable segment of our cinnamon teal population. Reference is made to one bird banded in southeastern Saskatchewan, as well as one indirect and three direct recoveries from Utah-banded birds, all recovered in central and southern California. Until such time as we have a greater number of banding returns which will tend to accentuate or lessen the relative importance of this movement, we can only say that there is a possibility that a sizeable segment of the Utah breeding population of cinnamon teal, as well as some of those on the northeastern periphery of the breeding range, fly southwestward to the west coast. Two other indirect recoveries give us further reason to believe that such a movement may exist. One Utah-banded bird was recovered in northeastern Montana, while a Kansas-banded bird was recovered in Wisconsin. This could be an indication of a northeasterly movement of lesser segments of the teal population to the northern and eastern limits of their breeding range. As the populations of this species east of the Continental Divide are small by comparison with that west of it, our primary interest would be with those breeding in the far western states, where nearly all records at present show them

utilizing a series of migration routes which tend to follow intermountain valleys. Fall and winter migration patterns show movements in a southeasterly direction into Mexico, while spring migrations would appear to be a reversal of this pattern in a northwesterly direction to the breeding grounds. Populations on the periphery of their range always tend to radiate from the centers of densest population. Because of this we cannot give credence at this time to any sizeable transmountain migrations of the cinnamon teal.

Summary of Direct Recoveries of Cinnamon Teal
Banded during summer or fall

Place of Banding	Place of Recovery	
Oregon	Mexico	2
	California	1
	Utah	1
	Colombia	1
California	California	52
	Mexico	3
Saskatchewan	California	1
Utah	Utah	10
	Mexico	6
	California	4
	Texas	2
	Colorado	1

Summary of Indirect Recoveries of Cinnamon Teal
Banded during summer or fall

Place of Banding	Place of Recovery	
California	California	25
	Mexico	5
	Utah	1
Oregon	California	2
	Mexico	1
Utah	Utah	2
	California	2
	Mexico	2
	Colorado	1
	Montana	1
Louisiana	Louisiana	1

MAP I. FALL MIGRATIONAL MOVEMENTS OF THE CINNAMON TEAL BASED ON DIRECT RECOVERIES OF BIRDS BANDED IN SUMMER AND FALL AND RECOVERED UP TO JANUARY 31 OF THE SAME SEASON (HEAVY BLACK LINE INDICATES BOUNDARIES OF ADMINISTRATIVE FLYWAYS).

Summary of Direct Recoveries of Cinnamon Teal
Banded during winter or spring

Place of Banding	Place of Recovery	
California	California	2
Oregon	California	2

Summary of Indirect Recoveries of Cinnamon Teal
Banded during winter or spring

Place of Banding	Place of Recovery	
California	California	2
	Mexico	2
	Nevada	1
Oregon	Oregon	1

SOUTHWARD MIGRATION OF THE SHOVELLER

By Jerome H. Stoudt

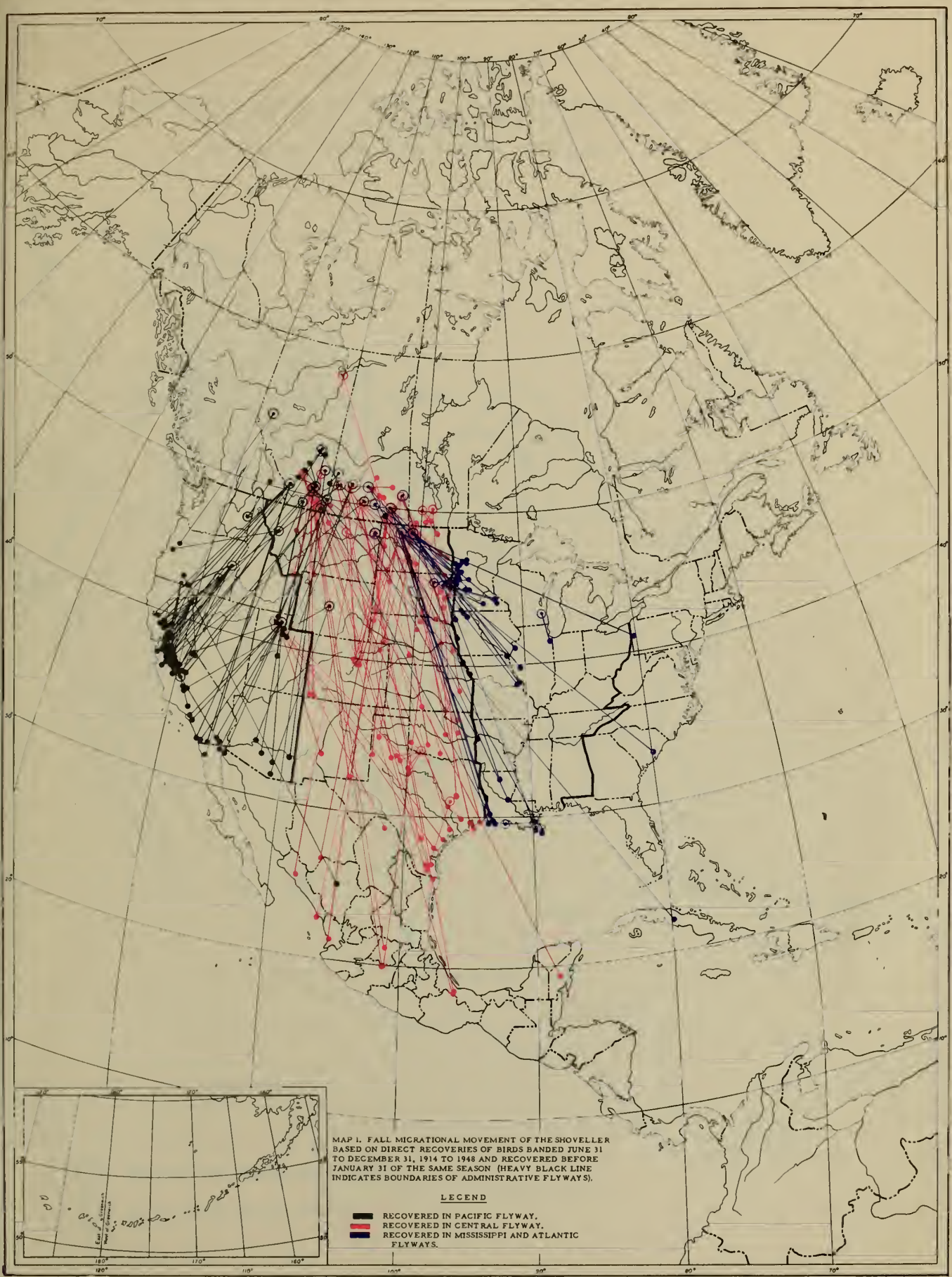
A total of 598 recovery records of shovellers were examined, dating back to 1914. Most of the shovellers were banded on the breeding grounds in the three prairie provinces of Canada or in North and South Dakota and in Utah and California.

Shovellers banded on the Canadian breeding grounds showed considerable overlapping in their southward migration, as shown by direct recoveries (Map 1). However, there seems to be a definite dividing line through the Rocky Mountain region so that in general birds migrating southeastward follow a flight line through Montana, the Dakotas, and Minnesota. The Mississippi River appears to be a rather definite eastern boundary of this migration, since there are only two recoveries east of that river (Ontario and Pennsylvania). For the most part, these shovellers come from Saskatchewan, but some come from eastern Alberta. Most of the Alberta birds, and some of the shovellers from Saskatchewan, appear to migrate south through the intermountain region from western Montana on down to Utah and from there to wintering grounds in California, or even Mexico. However, the route by which Canadian birds reach Mexico is not clear from the banding data.

When considering direct recoveries only (see Map 2), California recovered the "lions share" of the Alberta-banded birds with Mexico and Montana running a poor second and third, respectively. Of the birds banded in Saskatchewan, North Dakota harvested 11 percent, with South Dakota, Nebraska, and Texas following with 6-1/2 percent each. Saskatchewan hunters, however, took 29 percent before they left the breeding grounds.

The most northerly record was of a male shoveller which was taken during the first week of June 1940. This was evidently on its breeding grounds near the Arctic Ocean in northwestern Alaska. It had been banded in northern California in August 1939.

Two shovellers were taken in southern Mexico, a young male near Veracruz in January 1948, and a young female in the State of Quintana Roo at the southeast extremity of Mexico, in December 1947. Only one record was reported from Cuba and none from Central or South America.



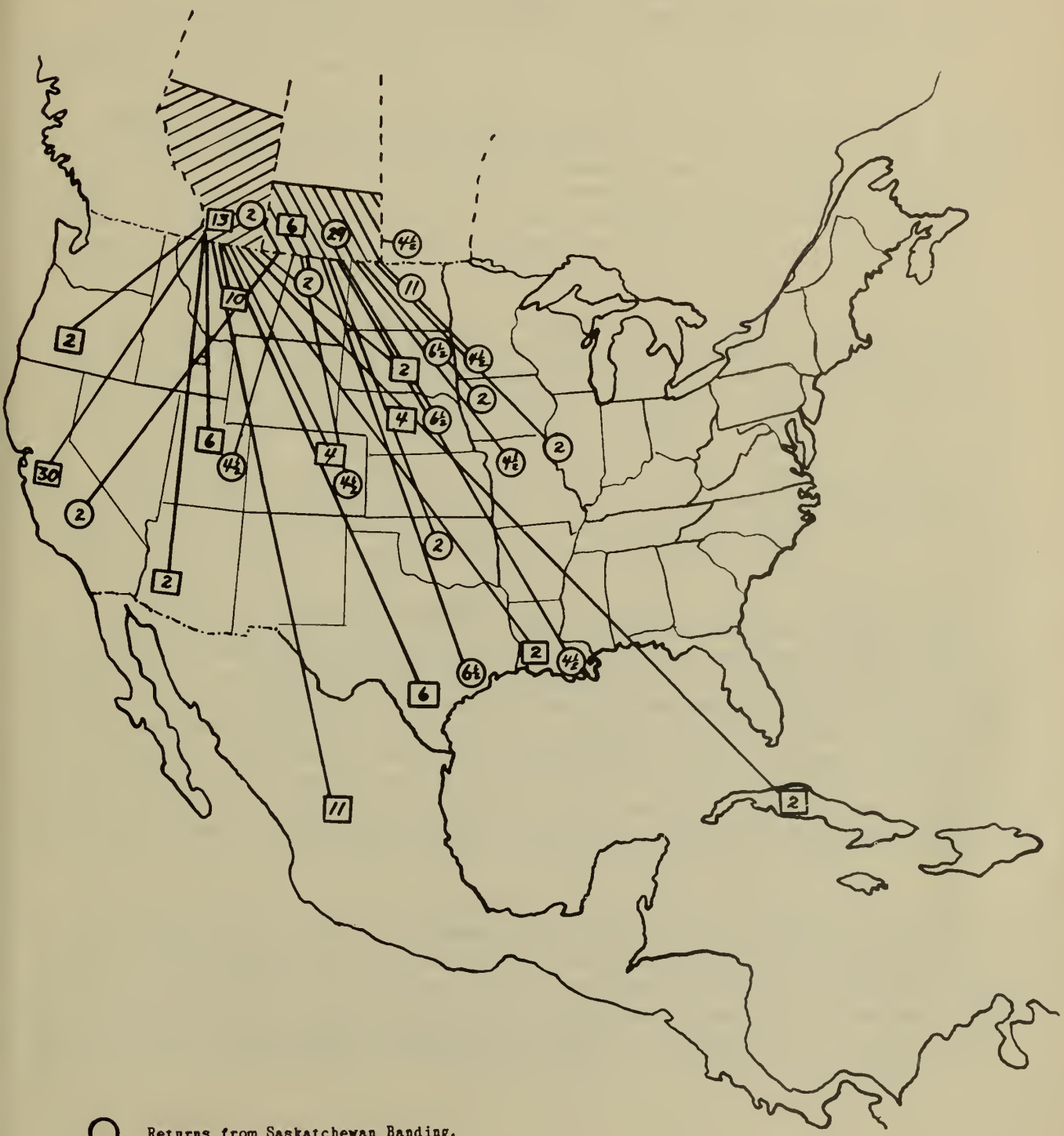
MAP 1. FALL MIGRATIONAL MOVEMENT OF THE SHOVELLER BASED ON DIRECT RECOVERIES OF BIRDS BANDED JUNE 31 TO DECEMBER 31, 1914 TO 1948 AND RECOVERED BEFORE JANUARY 31 OF THE SAME SEASON (HEAVY BLACK LINE INDICATES BOUNDARIES OF ADMINISTRATIVE FLYWAYS).

LEGEND

RECOVERED IN PACIFIC FLYWAY.
RECOVERED IN CENTRAL FLYWAY.
RECOVERED IN MISSISSIPPI AND ATLANTIC FLYWAYS.

Map 2. SHOVELLER

97 Direct Returns from Banding in Canada Expressed in Per Cent.
(52 Returns from Alberta Bandings)
(45 Returns from Saskatchewan Bandings)



○ Returns from Saskatchewan Banding.

□ Returns from Alberta Banding.

MIGRATION OF THE REDHEAD

By Chandler S. Robbins

The following summary of the migration of the redhead is based on an analysis of 2,097 return records from the 16,673 redheads banded through the end of calendar year 1948.

Movements of Pacific coast populations (Map 1).--Redheads banded in the fall in southeastern Oregon follow two general routes: 70 percent of the 80 direct recoveries were taken west of the banding station (Malheur Refuge) in Oregon and Washington, or in California, Nevada, western Arizona, or western Mexico (including Baja California). The remaining 30 percent moved in a general easterly direction, many following the Snake River at first, then scattering through the southern Great Plains.

Of the 46 indirect recoveries (not mapped), 59 percent went westward, the remainder to the east. This suggests a slight shift in favor of the plains at the expense of the Pacific states, but the sample is not large enough to make the difference significant. The general pattern of direct and of indirect recoveries is essentially the same.

California-banded redheads give a pattern almost identical to that of the western group from Malheur Refuge in southeastern Oregon, nearly all birds being confined to the immediate vicinity of California. Indirect recoveries are too few to map or discuss at the present time.

Movements of Great Basin populations (Map 2).--Banded redheads which are raised in the vicinity of Great Salt Lake, or which pass through there in the late summer or early fall, have furnished the greatest amount of information on the migratory habits of this species. Bear River and Ogden Bay Refuge birds scatter in all directions, many birds moving north to the Snake River, and some reaching to or even crossing the Canadian border before turning southward. The two principal flights appear to be:(1) South along the east shore of Great Salt Lake, thence to Utah Lake, and then through southwestern Utah and eastern Nevada to the Salton Sea region of southern California; and (2) eastward on a broad front to the western edge of the Great Plains, and then in a fairly direct line to the Gulf coast of southern Texas.

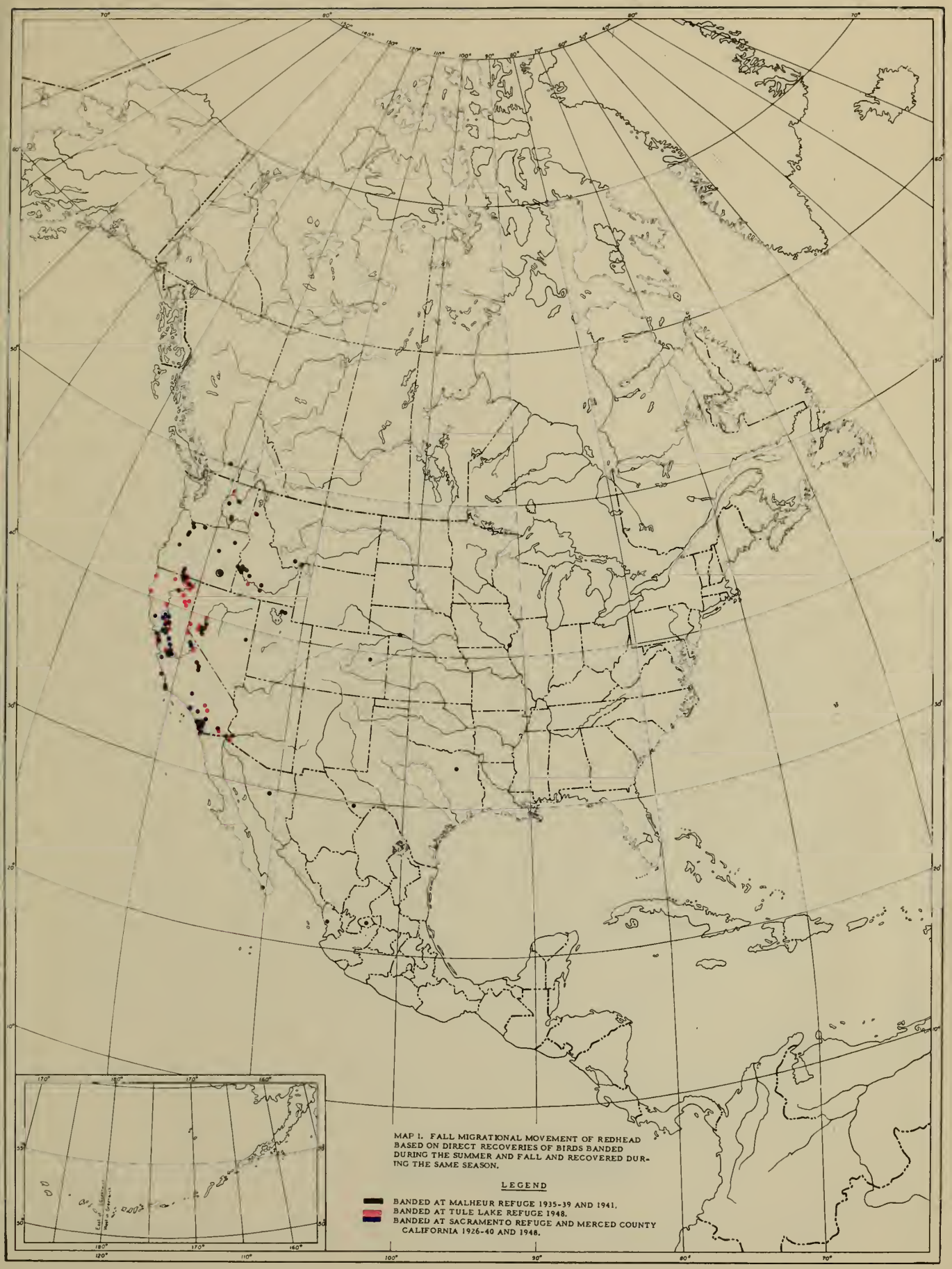
The percentage of birds moving east or west varies slightly from year to year, as does the amount of northward wandering, but on the average, 31 percent of the direct recoveries outside of Utah and Idaho (it being impossible to determine in which direction the birds from these two states would have gone), were from the west, and 69 percent from the east. A very small number go east of the plains and proceed to wintering grounds in Louisiana, or still more rarely via the Great Lakes to Chesapeake Bay.

Indirect recoveries are more widely scattered than are the direct ones. This is to be expected in view of the fact that not all the redheads banded in Utah in late summer and fall were raised in the Great Basin area. Therefore there is a broad scattering of indirect recoveries in the Prairie Provinces, and the percentage of recoveries in the Dakotas, Nebraska, Kansas, Minnesota, and Missouri is nearly triple that of direct recoveries. The percentage of indirect recoveries in Utah was only one-fourth as great as in the case of direct recoveries (even when recoveries in the immediate vicinity of the banding station are excluded), giving further evidence that birds from the Great Basin do not adhere to fixed routes year after year.

Of particular interest is the very high proportion of direct recoveries for this species.

As seen on the map, the number of Great Basin redheads recovered in the Great Lakes or in the Chesapeake Bay area is very small. In addition to the single direct recovery in Michigan, two birds found dead in Michigan and Ohio, respectively, the spring after banding, had moved far enough to the east of the other migration routes so that they may be considered as heading toward or from the Chesapeake Bay wintering ground; but even including these birds the number of individuals using the Atlantic route is less than one percent. On the other hand the number of indirect recoveries from the Great Lakes-Chesapeake route, which include two from Maryland, is only four percent of all indirect recoveries of birds banded in the Great Salt Lake area. Thus, both direct and indirect recoveries bear out the fact that any direct flight from Great Salt Lake to the Atlantic coast is quite insignificant. Since, out of nearly 5,500 redheads banded in the Great Salt Lake area, no direct recoveries have yet been reported beyond the Great Lakes, it cannot be safely stated that even a small number of redheads migrate regularly from Utah to Chesapeake Bay, as was formerly postulated on the basis of relatively few indirect recoveries. Thus the available evidence indicates that, while an occasional redhead from the Great Salt Lake population may find its way into the Great Lakes to Chesapeake Bay migration stream and continue on through to the Atlantic coast, this is not a regular procedure as may have been the impression from previous publications.

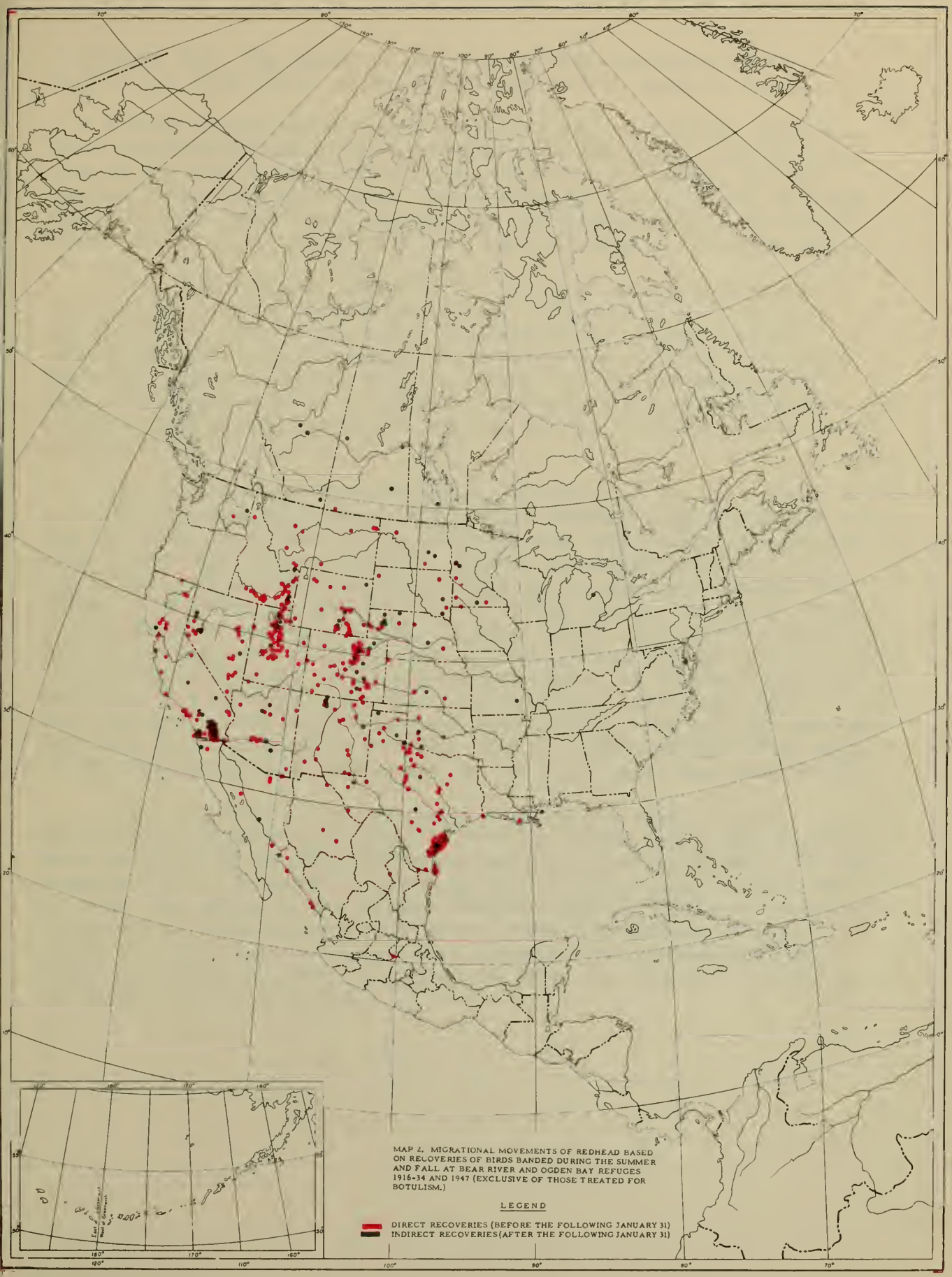
Movements of northern Great Plains populations (Maps 3 and 4).--Redheads banded in central and southern Alberta appear to go in approximately equal numbers to the Pacific States and to coastal Texas, whereas birds from the Athabaska Delta northeastern Alberta exhibit a tendency to disperse to all three of the principal wintering areas (Salton Sea, Texas coast and Chesapeake Bay). Unfortunately, so little banding has been done in Alberta that only very general conclusions can be drawn from the recoveries received to date; it is possible, however, that the Athabaska region furnishes redheads (to all three wintering grounds) in approximately equal numbers. About two-thirds of the Saskatchewan-banded redheads proceed to the Texas coast, staying to the east of the 100th Meridian; the other third move eastward through the Great Lakes, and then south to



MAP 1. FALL MIGRATIONAL MOVEMENT OF REDHEAD BASED ON DIRECT RECOVERIES OF BIRDS BANDED DURING THE SUMMER AND FALL AND RECOVERED DURING THE SAME SEASON.

LEGEND

BANDED AT MALHEUR REFUGE 1935-39 AND 1941.
BANDED AT TULE LAKE REFUGE 1948.
BANDED AT SACRAMENTO REFUGE AND MERCED COUNTY CALIFORNIA 1926-40 AND 1948.



MAP 2. MIGRATIONAL MOVEMENTS OF REDHEAD BASED ON RECOVERIES OF BIRDS BANDED DURING THE SUMMER AND FALL AT BEAR RIVER AND OGDEN BAY REFUGES 1916-34 AND 1947 (EXCLUSIVE OF THOSE TREATED FOR BOTULISM.)

Chesapeake Bay. The number of Saskatchewan birds recovered in the Mississippi River states south of Minnesota is very small (2 birds).

A still larger percentage of redheads banded in Manitoba favor the Great Lakes-Chesapeake route, three-fourths of the direct recoveries outside of the area of overlapping routes (Manitoba, Minnesota, and the Dakotas) being from this route. The Mississippi Valley flight, although always of minor importance compared with the flights through the Plains States and to the Atlantic coast, is relatively high for Manitoba birds.

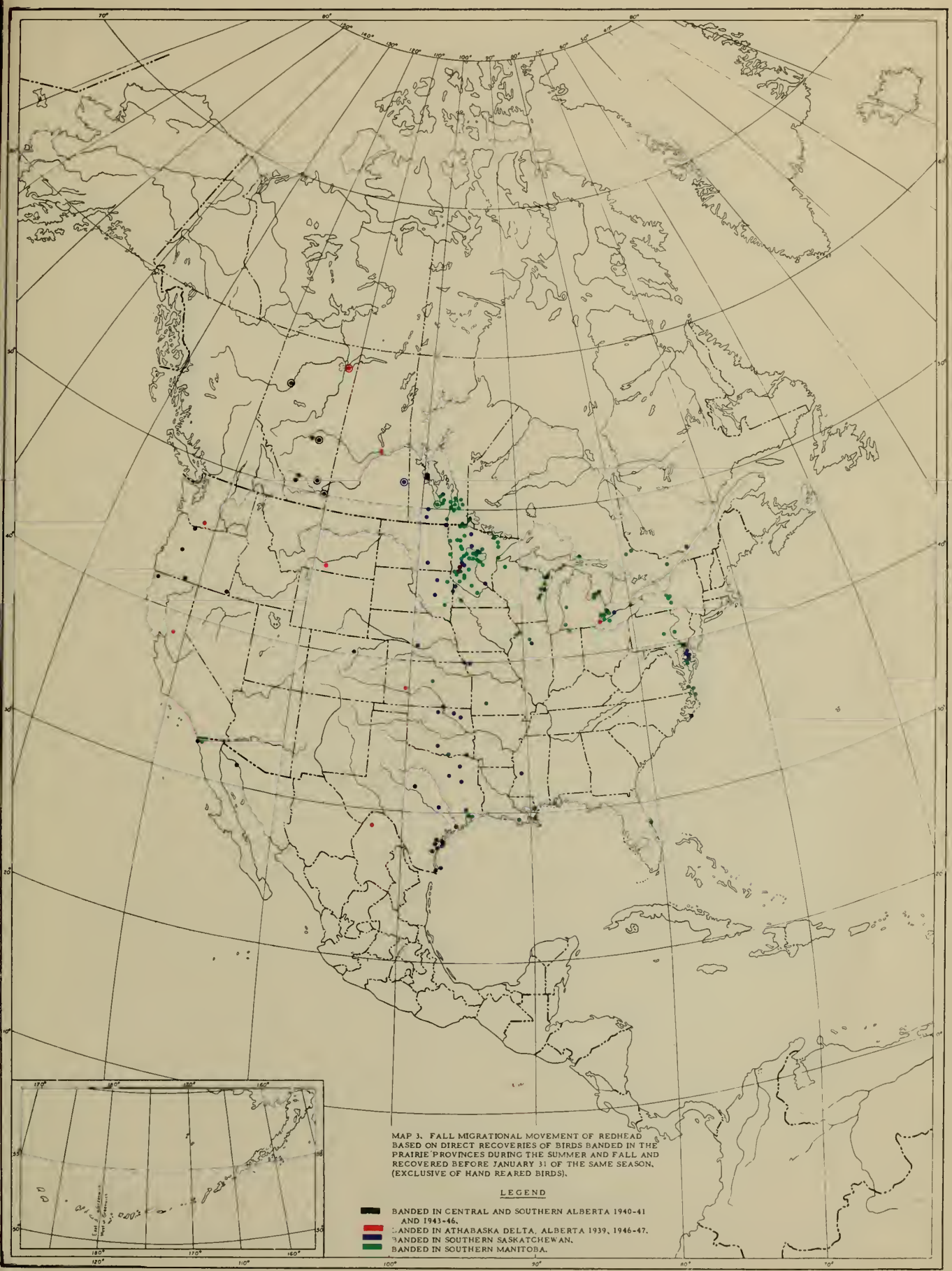
It is interesting to note that the dispersal of redheads banded in the Prairie Provinces shows a gradual and continuous shift from the Pacific States to Texas and then to Chesapeake Bay, as one considers banding stations from the western to the eastern part of the provinces. While the principal banding stations (except for the Athabaska Delta) have been lumped together by provinces in Map 3, the same trend is discernible in comparing recoveries from the various stations in each province.

Sand Lake National Wildlife Refuge, Columbia, S. Dak., is one of the few stations where an appreciable number of redheads have been banded during the spring migration. It presents the best opportunity to determine whether any major differences exist between the routes taken in spring and in fall. Direct fall recoveries (Map 4), as would be expected, lie primarily in two rather narrow and well-defined routes: one to the Texas coast, the other eastward through the Great Lakes. Indirect fall-to-fall recoveries show essentially the same pattern. Since most of the fall banding was done during the months of July and August, it is likely that the great majority of these birds were local ones. The fact that indirect fall recoveries give the same pattern as the direct ones and that neither have been taken north of the Canadian line is further evidence that most of the fall-banded birds were reared in the vicinity of Sand Lake Refuge.

Fall recoveries of spring-banded birds, on the other hand, give a significantly different pattern from the fall banded birds. Not only are there several fall recoveries from the Canadian breeding grounds, but the proportion of birds using the Great Lakes-Chesapeake route has been cut in half. The spring flight through Sand Lake Refuge, therefore, appears to consist of birds moving to the Saskatchewan and Manitoba nesting grounds. There is no indication that redheads from northeastern South Dakota use different routes in spring and fall, but only that two different populations are involved.

Percentages of all recoveries (except botulism, hand-reared and retrapped birds) recovered by State or Province

	Oreg. 155	Alberta 40	Utah 756	Sask. 119	N. Dak. 220	S. Dak. 202	Manitoba 242	Minn. 157
Ala.		3					1	1
Alta.	1	13	1/2	1	3	1/2		
Ariz.	1		3		1/2			
Ark.			+		1/2			
B. C.	1							
Calif.	45	9	16		1/2			
Colo.	1	3	12		2	1		
Fla.							1	
Ga.								1
Idaho	11		8		1/2			
Ill.				1	2	1	1	4
Ind.							1	1
Iowa	1				1	2	1	2
Kans.		3	1	2	8	8	2	3
La.			1/2		2	1/2	3	
Man.	1		+	11	2	3	29	3
Md.		3	1/2	10	5	2	7	11
Mich.		3	1/2	10	5	6	14	20
Minn.		6	2	12	13	29	28	37
Miss.				1	1/2		1	
Mo.	1		+	1			1	2
Mont.	2	3	2			2		
Nebr.	1		3	2	5	2	1	1
Nev.	11		6		1/2			
N. J.					1/2			
N. Mex.			5			1/2		
N. Y.				2	2	1/2	2	7
N. C.				1	1/2	2	2	6
N. Dak.			1	3	19	4	3	
Ohio			+			1/2		
Okla.	1		2	7	12	9	1	1
Ont.		3		3	1/2	3	8	10
Oreg.	14	12	1/2			1/2		
Pa.							2	
Que.				1				1
Sask.			1	8	2	2		
S. C.								1
S. Dak.	1	3	1	5	8	6	5	6
Tenn.				1	1/2			
Tex.	6	37	19	18	20	18	6	5
Utah	4		41	1				
Va.				2		1	3	5
Wash.	5		1/2		1			
Wis.		6		3	3	2	6	9
Wyo.	1		9		1/2	1/2		
Mexico	5	6	3	1				



MAP 3. FALL MIGRATIONAL MOVEMENT OF REDHEAD BASED ON DIRECT RECOVERIES OF BIRDS BANDED IN THE PRAIRIE PROVINCES DURING THE SUMMER AND FALL AND RECOVERED BEFORE JANUARY 31 OF THE SAME SEASON. (EXCLUSIVE OF HAND REARED BIRDS).

LEGEND

BANDED IN CENTRAL AND SOUTHERN ALBERTA 1940-41 AND 1943-46.
BANDED IN ATHABASKA DELTA, ALBERTA 1939, 1946-47.
BANDED IN SOUTHERN SASKATCHEWAN.
BANDED IN SOUTHERN MANITOBA.

MAP 4. MIGRATIONAL MOVEMENT OF REDHEAD BASED ON RECOVERIES OF BIRDS BANDED AT SAND LAKE REFUGE, SOUTH DAKOTA.

LEGEND

DIRECT RECOVERIES OF FALL BANDED BIRDS 1937-39.
INDIRECT RECOVERIES OF BIRDS BANDED IN FALL (1937-39 AND 1941) AND RECOVERED DURING SUBSEQUENT FALL SEASONS.
RECOVERIES OF BIRDS BANDED IN SPRING (1938) AND RECOVERED DURING SUMMER AND FALL.

MIGRATION OF THE RING-NECKED DUCK

By Allen J. Duvall

The ring-necked duck is essentially a fresh-water duck of the interior and generally prefers ponds, marshes, and sloughs to the open lakes and streams. It is far less common in broad, open waters than others of the diving ducks. Since very little banding has been done on the breeding grounds, the migration patterns to the wintering grounds have been worked out with recoveries of birds banded away from the breeding region and recovered in the nesting range, or enroute to or from it. Ring-necked ducks of the Pacific coast area have not been discussed in this report because of the small amount of data.

Breeding and Wintering Areas

The breeding grounds of the ring-neck extend from the interior valleys of British Columbia eastward to Newfoundland, as outlined on Map 2. There is evidence that the species has extended its range eastward within recent years. The few isolated instances of the species breeding south of the area outlined are not included in this discussion. The wintering grounds extend from the Pacific to the Atlantic coast, north to Puget Sound, Arkansas, and Chesapeake Bay, south to the West Indies, Mexico and Guatemala, but the bulk of the ring-necks winter along the Gulf coast and in the South Atlantic States from South Carolina to Florida.

Migration Patterns

The movement of ring-necks from the breeding grounds to their wintering areas is shown by samples banded mainly in Manitoba, Minnesota, Michigan, Illinois, Indiana, Ontario, Maine (Map 1); and South Carolina, Georgia, Florida, Louisiana, and Oklahoma (Maps 2 and 3). There were approximately 2,800 (13 percent) recoveries available for this report from 22,000 birds banded.

Birds wintering in South Carolina apparently come from that segment of the breeding area extending from Saskatchewan and Manitoba, east to Quebec and New Brunswick, and south to Michigan, Wisconsin, and Minnesota. Birds wintering in Louisiana or passing southwest through this state apparently come from all parts of the breeding grounds with the exception of British Columbia, and that portion of the eastern areas in the Maritime region of Canada and in the northeastern United States.

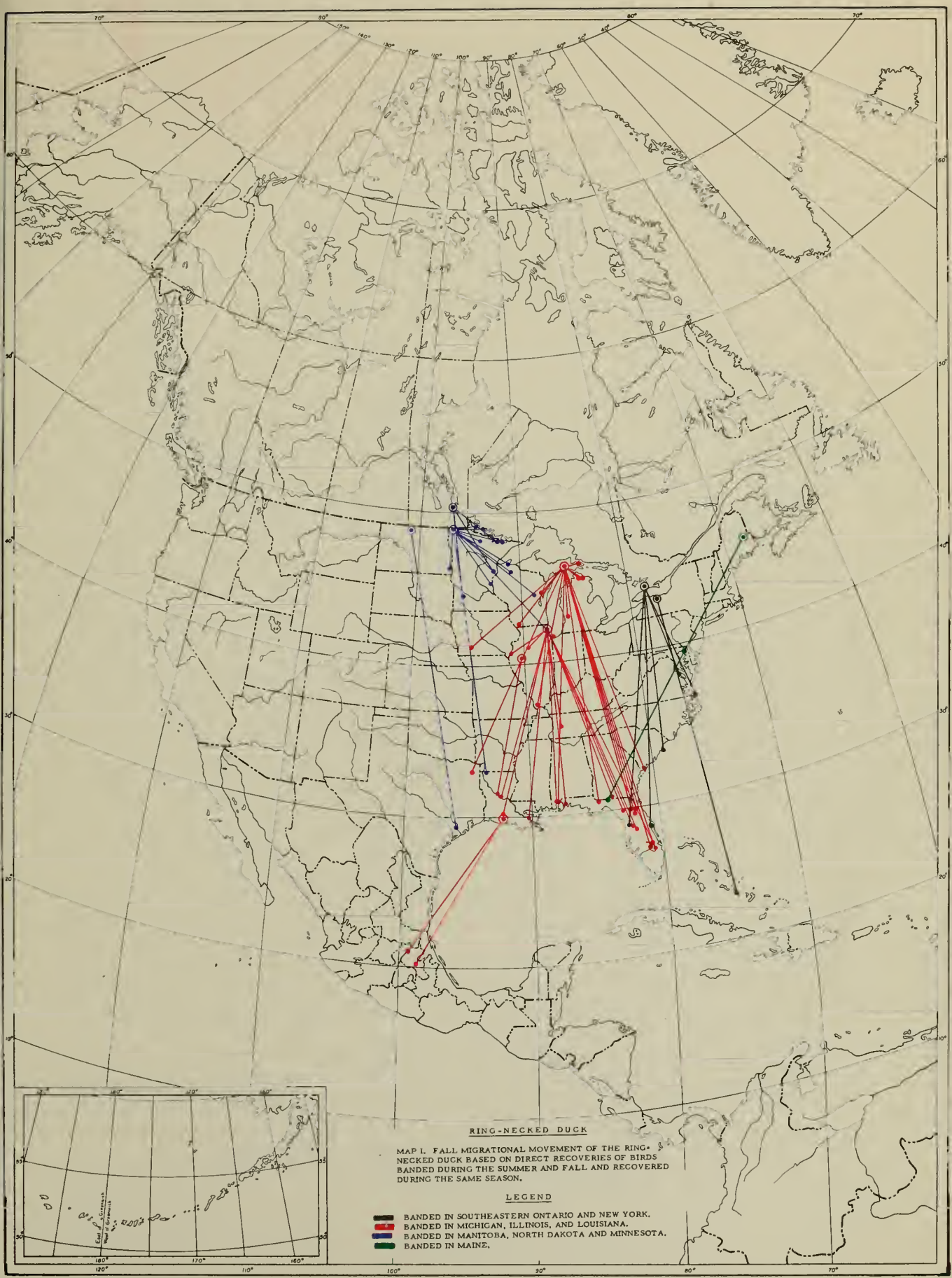
The migration pattern from the breeding area in Saskatchewan and Manitoba to the wintering grounds in South Carolina is principally via the states bordering the Great Lakes and Chesapeake Bay, while some go via an interior route southwest of Chesapeake Bay. This is shown by South Carolina-banded birds recovered during the fall migration in Minnesota

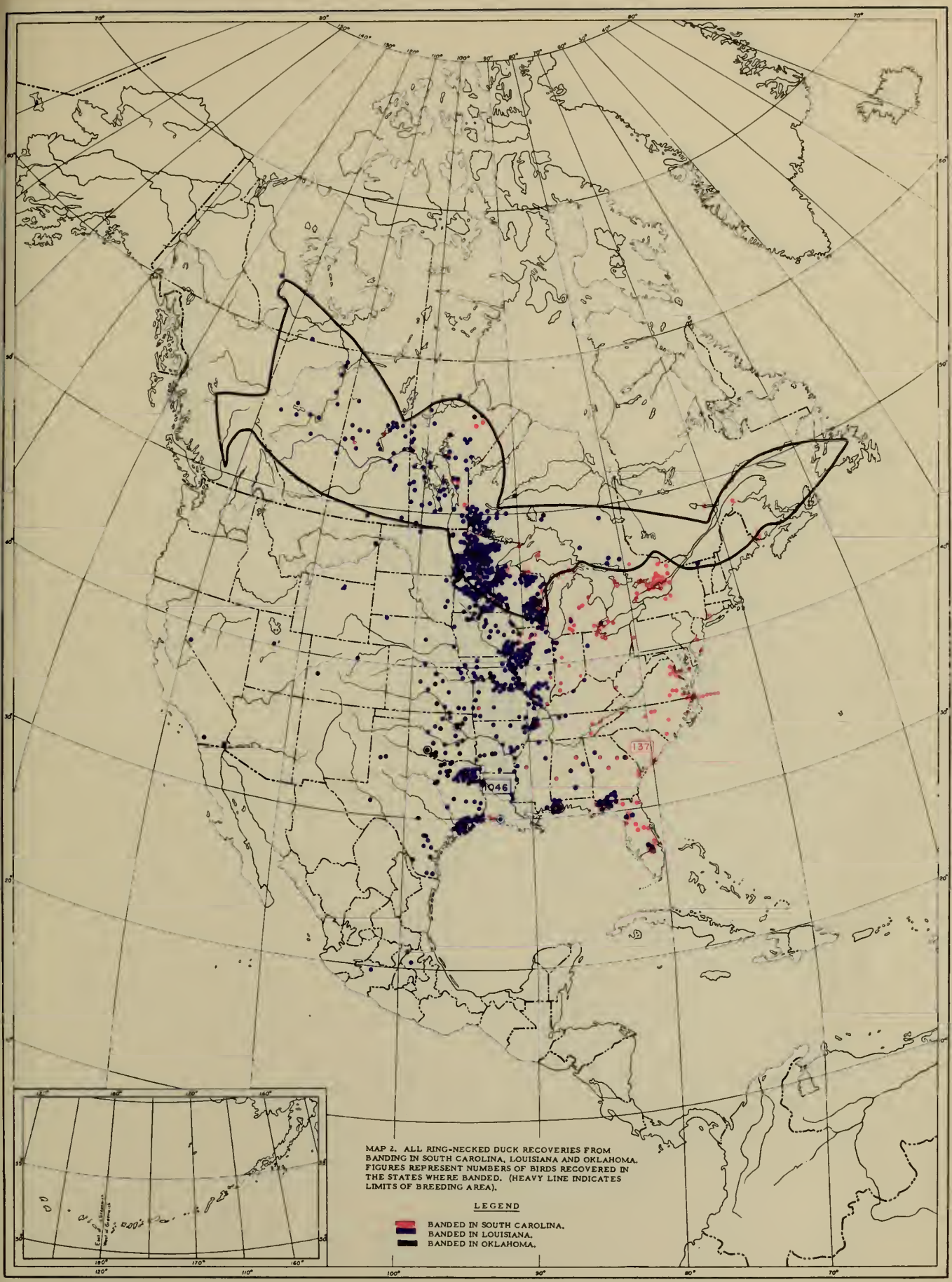
(16), Wisconsin (20), Ontario (29), Maryland (2), and Virginia (22) for the principal pattern; and for the second pattern - Illinois (11), Indiana (4), Kentucky (1), Tennessee (2), and North Carolina (3). Further evidence for part of the movement through the Chesapeake Bay area is shown by birds banded in the fall in southeastern Ontario (Lake Scugog), and recovered (both direct and indirect) in Maryland, Virginia, and South Carolina as well as in Florida. It should be noted, however, that some fall recoveries from the southeastern Ontario-Chesapeake Bay route might represent birds which came from the northeastern part of the breeding range.

Banding data to show the spring movement to the breeding grounds of the ring-necks wintering in South Carolina is not clearly defined, but banding in this State suggests three patterns: (1) Northwestward through eastern Tennessee, Kentucky, and Indiana, four direct spring recoveries; (2) north via the Chesapeake Bay area to the Great Lakes (one direct spring recovery in western Pennsylvania and one in southeastern Ontario); (3) north from Chesapeake Bay into the maritime provinces of Canada (indirect spring recovery in New Brunswick).

From the breeding areas in Mackenzie, the prairie provinces, and western Ontario, the migration pattern to the wintering grounds in Louisiana and parts of the Gulf coast seems to be chiefly via the Mississippi River and its tributaries. This is illustrated by the large number of birds banded in Louisiana (Maps 2 and 3) and recovered during the fall migration period in Minnesota (200), Wisconsin (80), Iowa (26), Illinois (73), extreme western Tennessee (31), Missouri (34), Oklahoma (10), and Arkansas (16). A movement eastward along the Gulf coast from Louisiana is suggested by winter and fall, direct and indirect, recoveries in Alabama (10) and Florida (19); and by indirect fall recoveries in the states bordering the Mississippi River of birds banded in Georgia; and southwestward by fall and winter, direct and indirect, recoveries in Texas (75) and Mexico (3). Additional evidence supporting the route traveled by ring-necks from their nesting areas to Louisiana and the Gulf coast is through direct recoveries from birds banded in November in Illinois: five in Louisiana, one in Alabama, and one in extreme western Florida. That few ring-necks wintering in Louisiana come from or pass through Michigan is indicated by the extremely small number of recoveries in that State (2) from Louisiana, as well as the small number of recoveries in Louisiana (1) of birds banded in Michigan. Apparently the bulk of the birds leaving Michigan, winter in Florida; and in part, probably follow the Great Lakes - Chesapeake Bay route as suggested for the birds reaching South Carolina. Fall recoveries of Michigan banded birds in central New York, along Delaware and Chesapeake Bays, and in South Carolina support this.

There are much less banding data to illustrate the movement of birds from the Gulf coast of Louisiana during the spring migration; however, direct recoveries of southern Louisiana banded birds from Mississippi (1),

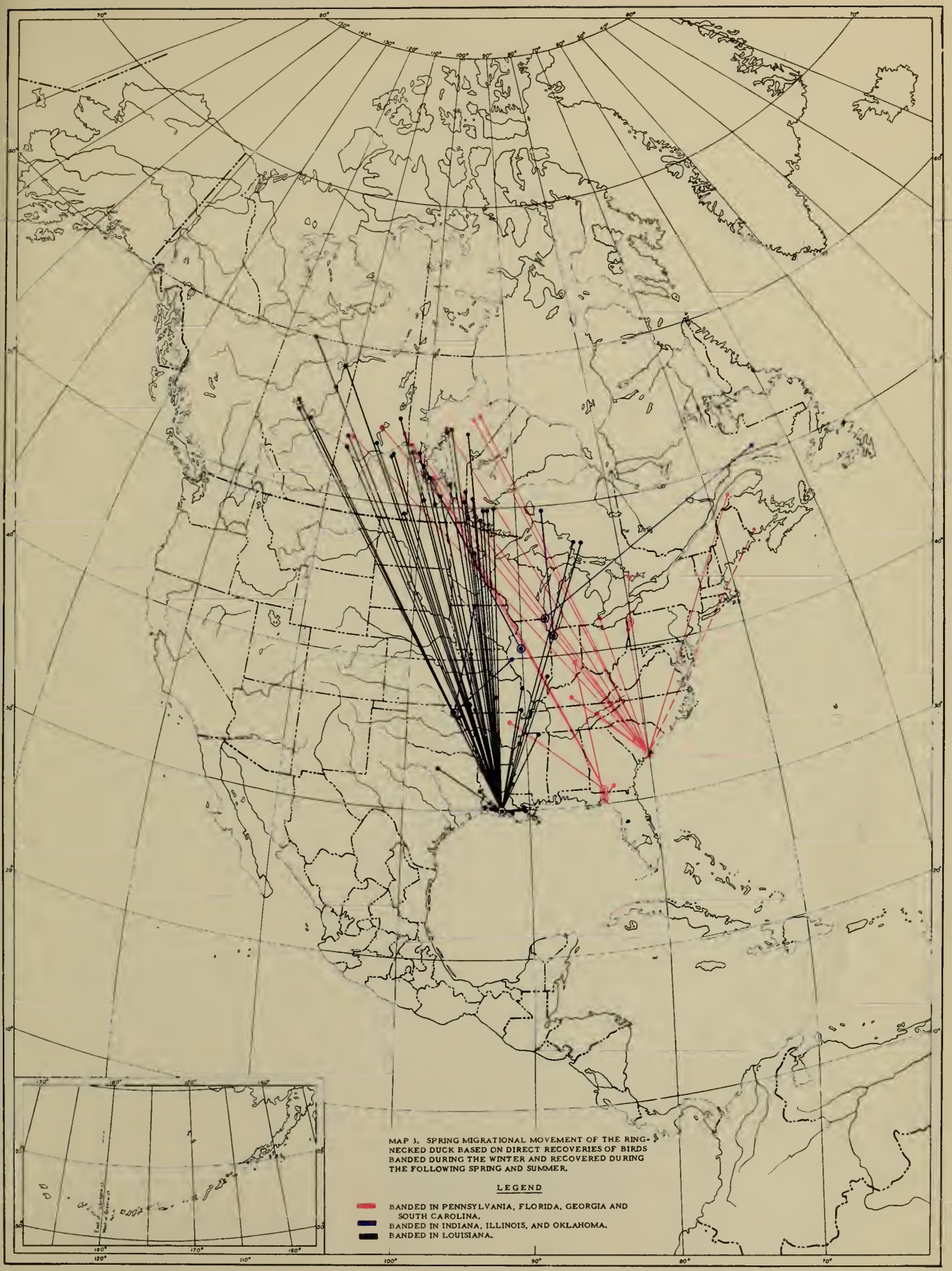

RING-NECKED DUCK
MAP I. FALL MIGRATIONAL MOVEMENT OF THE RING-NECKED DUCK BASED ON DIRECT RECOVERIES OF BIRDS BANDED DURING THE SUMMER AND FALL AND RECOVERED DURING THE SAME SEASON.
LEGEND
BANDED IN SOUTHEASTERN ONTARIO AND NEW YORK.
BANDED IN MICHIGAN, ILLINOIS, AND LOUISIANA.
BANDED IN MANITOBA, NORTH DAKOTA AND MINNESOTA.
BANDED IN MAINE.



MAP 2. ALL RING-NECKED DUCK RECOVERIES FROM BANDING IN SOUTH CAROLINA, LOUISIANA AND OKLAHOMA. FIGURES REPRESENT NUMBERS OF BIRDS RECOVERED IN THE STATES WHERE BANDED. (HEAVY LINE INDICATES LIMITS OF BREEDING AREA).

LEGEND

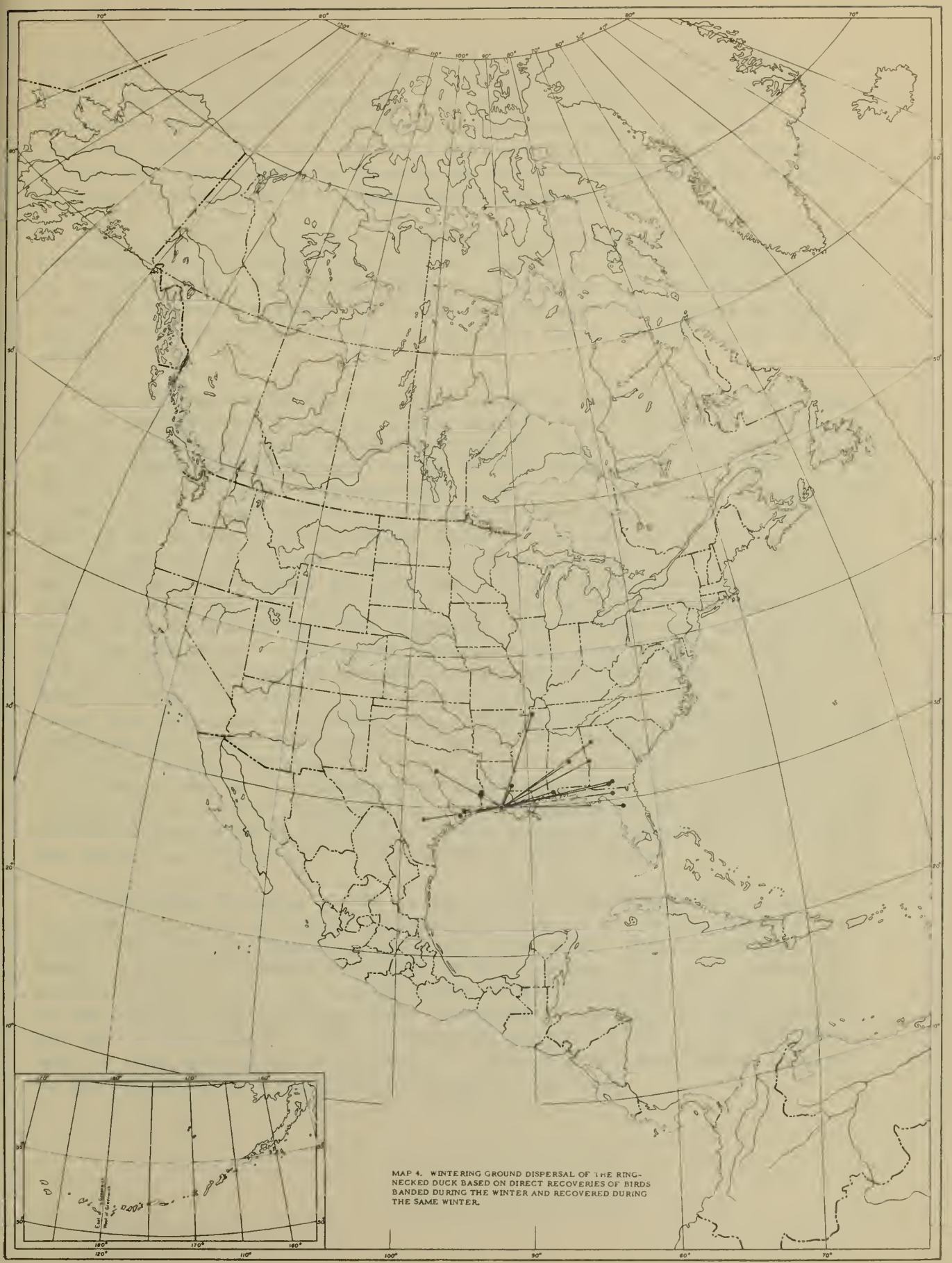
BANDED IN SOUTH CAROLINA.
BANDED IN LOUISIANA.
BANDED IN OKLAHOMA.



MAP 3. SPRING MIGRATIONAL MOVEMENT OF THE RING-NECKED DUCK BASED ON DIRECT RECOVERIES OF BIRDS BANDED DURING THE WINTER AND RECOVERED DURING THE FOLLOWING SPRING AND SUMMER.

LEGEND

- BANDED IN PENNSYLVANIA, FLORIDA, GEORGIA AND SOUTH CAROLINA.
- BANDED IN INDIANA, ILLINOIS, AND OKLAHOMA.
- BANDED IN LOUISIANA.



MAP 4. WINTERING GROUND DISPERSAL OF THE RING-NECKED DUCK BASED ON DIRECT RECOVERIES OF BIRDS BANDED DURING THE WINTER AND RECOVERED DURING THE SAME WINTER.

Arkansas (2), Oklahoma (1), Missouri (7), Tennessee (1), Illinois (1), and Minnesota (1), indicate that these ring-necks follow a similar pattern during the two migration periods. In addition, there are indirect spring recoveries from several of the states just mentioned. In Canada, recoveries (both direct and indirect) indicate that ring-necks disperse over a wide area from Ontario to Alberta and southern Mackenzie, and that most of them are recovered in western Ontario and Manitoba.

Map 4 shows a dispersal of some ring-necks banded in southern Louisiana during November and December (except 1). Those recovered east of the Mississippi River were likewise in November and December of the same year as banded (except 1). Banding data are insufficient to show how ring-necks moving eastward as illustrated in Map 4, return to the nesting grounds.

All the recoveries (55) of birds banded at two stations in Oklahoma (Map 2) were banded during the spring migration with only four exceptions, and all except four were recovered during the fall or winter period. Most of the recoveries (93 percent) in the United States were taken west of the Mississippi River and it appears that birds moving south from the breeding grounds do not reach the Gulf coast via the Mississippi River but do so through the Southern Great Plains. This is indicated by the relatively large number of recoveries south of the 40th parallel in this latter region and in Texas, while there are only two from Louisiana (northwestern). The exact breeding area for these birds cannot be definitely determined because there have been only two recoveries from Ontario (one not mapped) and one from Manitoba. Of the birds recovered away from Oklahoma, Texas (28 percent) and Minnesota (18 percent) accounted for almost half of them. Thus, it seems that Texas is the wintering grounds for ring-necks which reach that State via two routes; one following the Mississippi River to the Louisiana Gulf coast and Texas, and another one through the eastern part of the Great Plains. This parallels the situation in Florida, in that there is evidence (Map 4) to indicate that ring-necks reach this State, also, by two different routes. Banding data are too incomplete to show the pattern northward from Oklahoma during the spring migration since there are only two spring recoveries in the United States from Oklahoma.

Ring-necks breeding in the northeastern United States and in the Maritime Provinces of Canada apparently winter in the South Atlantic States which they reach by migrating along the east coast. This conclusion is based on only two direct recoveries of Maine-banded birds; one taken in Maryland (Havre de Grace) and one taken in Florida (Leon County); as well as two South Carolina-banded birds recovered in the fall in New Brunswick, and one in Connecticut. Data to show the pattern for the northward movement is even more meager since there is only one indirect spring recovery in New Brunswick of a bird banded in South Carolina.

DISTRIBUTION AND MIGRATION OF CANVAS-BACK POPULATIONS

By Robert E. Stewart

This study is based on the analysis of 586 banding recoveries. Mapping of recoveries discloses that movements of canvas-backs between their breeding and wintering grounds follow four rather well-defined pathways or "species flyways." Two of these, the Atlantic and Mississippi canvas-back flyways proceed together for part of the way over a "trunk route." (See Map 1).

Breeding Areas

The principal breeding population of the canvas-back is found in the Prairie Provinces of Canada, namely Alberta, Saskatchewan, and Manitoba. Smaller numbers are also to be found in North Dakota, South Dakota, British Columbia, Alaska, and in a few scattered outlying stations in the northwestern states.

Migration

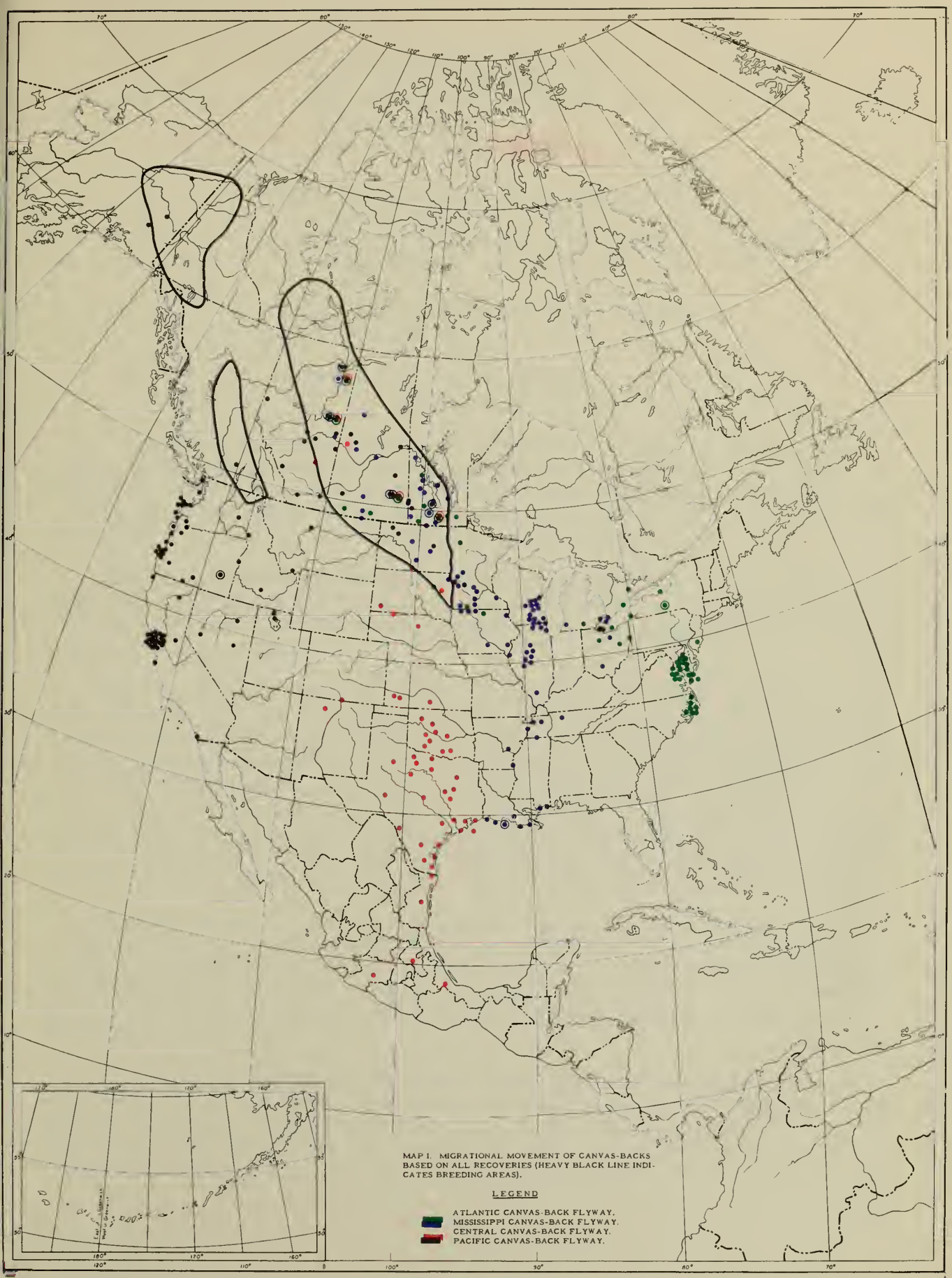
The distribution, by species flyways, of recoveries of birds banded in each of these areas during the breeding season, is indicated as follows (letters J and A are used for juvenals and adults, respectively):

Alberta banded (19 recovered)
- Atlantic flyway - 1 (J)
- Central flyway - 6 (4J, 2A)
- Pacific flyway - 12 (9J, 3A)

Saskatchewan banded (28 recovered)
- Atlantic flyway - 9 (6J, 3A)
- Mississippi flyway - 3 (2J, 1A)
- Atlantic-Mississippi trunk route - 9 (J)
- Central flyway - 5 (J)
- Pacific flyway - 2 (1J, 1A)

Manitoba - wild birds banded (16 recovered)
- Atlantic flyway - 4 (3J, 1 undetermined)
- Mississippi flyway - 2 (J)
- Atlantic-Mississippi trunk route - 7 (4A, 3J)
- Central flyway - 1 (J)
- Pacific flyway - 2 (1J, 1A)

Manitoba - hand-reared birds banded (24 recovered)
- Atlantic flyway - 5 (4J, 1A)
- Mississippi flyway- 3 (J)
- Atlantic-Mississippi trunk route - 13 (J)
- Central flyway - 3 (J)



MAP I. MIGRATIONAL MOVEMENT OF CANVAS-BACKS BASED ON ALL RECOVERIES (HEAVY BLACK LINE INDICATES BREEDING AREAS).

LEGEND

ATLANTIC CANVAS-BACK FLYWAY.
MISSISSIPPI CANVAS-BACK FLYWAY.
CENTRAL CANVAS-BACK FLYWAY.
PACIFIC CANVAS-BACK FLYWAY.

North Dakota banded (5 recovered)
Mississippi flyway - 1 (A)
Atlantic-Mississippi trunk route - 1 (J)
Central flyway - 1 (J)
Pacific flyway - 2 (A)

South Dakota-banded (7 recovered)
Atlantic flyway - 1 (J)
Atlantic-Mississippi trunk route - 3 (2A,1J)
Central flyway - 3 (1J, 2A)

British Columbia-banded (1 recovered)
Pacific flyway - 1 (J)

Montana banded (1 recovered)
Pacific flyway - 1 (J)

In general, although there is considerable overlap in the ranges of the breeding populations of the respective species flyways, it may be said that the eastern half of the breeding area supplies most of the birds for the Atlantic and Mississippi flyways, while the western half furnishes most of the birds for the Pacific and Central flyways.

The banding data are insufficient to show any difference in the migration behavior of juvenals and adults. However, enough records are available to show that the migration routes of hand-reared birds, and wild birds are similar.

Atlantic flyway.--The migration route of the Atlantic flyway population extends from the breeding areas to the Great Lakes region via the Atlantic-Mississippi trunk route, and from there to the wintering grounds on the coastal tide-waters of Maryland, Virginia, and northern North Carolina. During mild, open winters, fairly large numbers sometimes remain in the Lake St. Clair region of Michigan and Finger Lake region of New York. Occasional small numbers are also found along the South Atlantic coast but it is not known whether these are stragglers from the Atlantic flyway wintering ground or from the Mississippi flyway wintering ground.

A total of 26 recoveries were made in the Atlantic flyway wintering area of birds banded on the breeding grounds or in the Finger Lake region of New York. Of these, 16 were taken in Maryland, five in Virginia and five in North Carolina. Thus, it appears that a very large percentage of the birds shot on the Atlantic flyway wintering ground are taken in Maryland.

Of the birds banded in the Finger Lake region of New York, 22 were recovered out of the State. Of these, 16 were taken in the wintering ground (Maryland, Virginia, and North Carolina) and four along the migration route (Minnesota and Ontario). Only two were taken in the breeding ground.

On the basis of comparative number of recoveries, the Lake St. Clair region of Michigan and Ontario is the most important stop-over station along the migration route of the Atlantic canvas-back flyway.

Mississippi flyway.--The migration route of the Mississippi canvas-back flyway extends southeast from the Canadian breeding areas to the Great Lakes region via the Atlantic-Mississippi trunk route and thence down the Mississippi and Ohio River Valleys to the wintering grounds on the coasts of Louisiana, Mississippi, and Alabama.

Thirty-five birds banded at Avery Island, Louisiana, were recovered on the breeding areas. Of these 12 were taken in Manitoba, 10 in Saskatchewan, six in Alberta, five in North Dakota, and two in South Dakota. It appears from these data that at least 80 percent of the birds wintering in Louisiana breed in the Canadian prairie provinces, with Manitoba and Saskatchewan being used by the majority of the population.

Interchange or overlapping of populations between the various species flyways may be considerable at times. Out of 54 birds banded at Avery Island (Mississippi flyway) and recovered on the wintering areas during succeeding years, 31 were retaken in the Mississippi flyway (not including returns at Avery Island), 12 in the Central flyway, seven in the Atlantic flyway, and four in the Pacific flyway. It seems probable that the Mississippi flyway is affected by shifts in population more than the others, since its wintering area lies adjacent to the wintering area of the Central flyway, while in the north the migration route is united with the Atlantic flyway.

Some idea of the general hunting pressure in this flyway is indicated by the fact that out of 144 recoveries of birds banded at Avery Island, Louisiana, 66 were taken along the migration routes, 54 on the wintering grounds, and 35 on or near the breeding areas. A more detailed breakdown of the recoveries in the leading states or provinces, representing about 70 percent of total kill of birds banded in Louisiana, follows: Louisiana (other than Avery Island), 30; Wisconsin, 17; Minnesota, 14; Manitoba, 12; Illinois, 11; Saskatchewan, 10; Texas, 9.

Only four birds banded on the breeding areas were retaken on the Mississippi flyway wintering ground. Two of these were taken in Louisiana and two in Alabama.

Information derived from the banding data shows that the more important stop-over stations along the migration route of the Mississippi flyway population include the Christina Lake region of west-central Minnesota, the Lake Winnebago region, and smaller lakes in the southern part of Wisconsin, and the Illinois River in Illinois.

Atlantic-Mississippi trunk route.--On the migration route between the Great Lakes region and the breeding areas, the Atlantic and Mississippi canvas-back flyways are united to form one large trunk route. A

total of 38 recoveries were made of birds, banded on the breeding area which pass through this common route during migration. The distribution of these recoveries is: Minnesota, 11; Maryland, 7; Wisconsin, 6; Ontario, 3; Virginia, 2; North Carolina, 2; Louisiana, 2; Alabama, 2; New York, 1; Florida,1; Illinois, 1.

On the basis of these data the following generalizations may be made of this mixed flyway population: (1) Over half of the birds shot are taken during migration, mostly in Minnesota and Wisconsin; (2) the number of birds that use the wintering area of the Atlantic flyway is probably greater than the number that use the wintering area of the Mississippi flyway; (3) Minnesota, Maryland, and Wisconsin account for about two-thirds of the total kill of banded birds.

Central flyway.--This canvas-back flyway extends in a south-southeastward direction from the Canadian prairie province breeding ground to the wintering area in Central Mexico and the Gulf coast of Texas.

A total of 13 birds banded in the northern breeding areas were recovered in the Central flyway. The distribution of these recoveries is indicated as follows: Texas, 6; Oklahoma, 3; Mexico, 1; Kansas, 1; South Dakota, 1; and North Dakota, 1. From these data it would appear that the majority of the birds killed in the Central flyway are taken in Texas and Oklahoma.

The banding data indicates that there may be considerable overlap of the wintering populations of the Central flyway with the wintering populations of the Mississippi flyway.

Pacific flyway.--The principal part of the Pacific flyway extends in a broad front from the breeding areas in the Canadian prairie provinces to the coastal areas of Washington, Oregon, and the northern half of California. Two secondary breeding areas are found in central Alaska and in lower British Columbia.

The line of flight from the Alaskan area could not be determined from the banding data available. In winter fairly large numbers are sometimes found in southern California, especially in the Imperial Valley.

Fourteen birds banded at Tillamook Bay, Oregon, were recovered on the breeding grounds. Of these six were taken in Saskatchewan, four in Alberta, three in Alaska and one in Manitoba. On the basis of this information it would appear that the majority of the Pacific flyway birds which have been banded, nest in Saskatchewan and Alberta.

A total of 60 birds banded at Tillamook Bay, on the coast of Oregon, were recovered during succeeding years. Only one of these was taken outside of the Pacific flyway, a bird shot in Louisiana. Forty-six of the Tillamook Bay birds were recovered on the Pacific coast, 30 having been

taken in Oregon, 10 in Washington, 5 in California, and 1 in British Columbia. On the other hand, the indirect recoveries of eight birds banded at Lake Malheur, located along the migration route in southeastern Oregon show quite a different picture. Of these, seven were recovered in California and only one in Oregon. It would be expected that more recoveries would be made near banding stations located in a wintering area than would be made near stations along the migration route since the latter are generally used by canvas-backs for comparatively short periods.

The 60 birds banded at Tillamook Bay and recovered in succeeding years show the following distribution of hunting pressure: Winter areas - 47 birds (78 percent); breeding areas - 10 birds (17 percent); and migration areas - 3 (5 percent). A more detailed breakdown of hunting pressure on the wintering area is furnished by the distribution of winter recoveries of birds banded on the breeding areas of the Canadian prairie provinces. The 16 recoveries thus made are distributed as follows: California, 12; Washington, 2; Oregon, 1; and British Columbia, 1. Thus it appears that of these samples, the majority of the birds killed in the Pacific canvasback flyway are taken in California.

MIGRATION OF THE GREATER SCAUP DUCK

By John W. Aldrich

Range

Before considering the significance of recoveries of this species it was necessary to revise existing concepts of the breeding range. This is made difficult because of the confusion which has existed in distinguishing between the greater and lesser scaup in the field. Revision of range was accomplished by re-evaluation of published records in the light of Museum specimens and correspondence with biologists familiar with the species in the field. So far as the Western Hemisphere is concerned the revised breeding range, indicated by the heavy black line on the map, is confined almost entirely to the far northern regions of western North America, but with a small population of doubtful permanency on islands in the Gulf of St. Lawrence. For valuable information in this connection acknowledgment should be made to Dr. Harrison Lewis, J. Dewey Soper, A. C. Bent, Frank L. Farley, B. W. Cartwright, W. Earl Godfrey, L. T. S. Norris-Elye, R. W. Tufts, Fred G. Bard, George F. Boyer, and W. A. Squires.

The winter range of the greater scaup is confined chiefly to the deeper, open waters of our coastal bays and sounds and some of the larger lakes; from southeastern Alaska, south to middle California on the Pacific coast, and from Massachusetts south to Florida on the Atlantic Coast, west along the Gulf coast to Corpus Christi, Texas; also the more southern Great Lakes.

Migration

Since no greater scaups have been banded on or even near their breeding grounds, direction and course of southward movement cannot be determined from direct recoveries but must be inferred from birds banded on their wintering grounds or during migration and recovered during subsequent fall migrations. A total of 2,894 greater scaups have been banded and 304 recoveries have been mapped and analyzed in this study. Retraps of birds at the same station where banded have not been utilized. Practically all of the recoveries away from the breeding grounds shown on the map were made during the hunting season, at which time the birds were in southward migration or on their wintering grounds. There are too few spring recoveries south of Alaska to indicate the pattern of spring migration.

Pacific coastal populations.--Knowledge of the greater scaups which winter on the Pacific coast is based entirely on banding on the coast of northwestern Oregon in fall, winter, and spring. It would appear from the recoveries (see accompanying map) that the breeding grounds of this population are on the coast of western Alaska. Most of the Alaskan recoveries

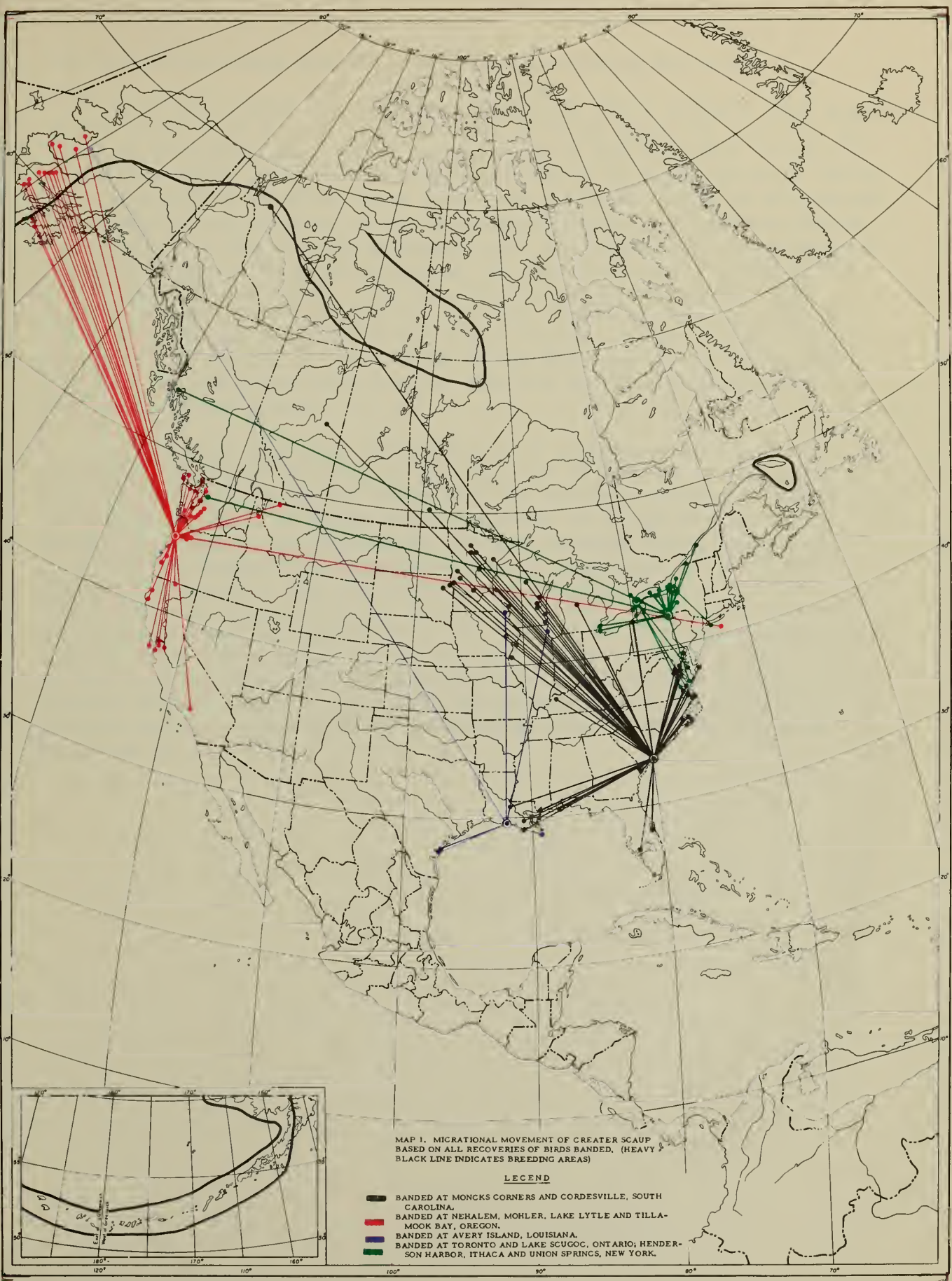
of this group were obtained in May or June. The birds apparently migrate southward from western Alaska, possibly too far off shore to be taken very often by hunters, until they reach southern Vancouver Island, B. C. From that point southward around Puget Sound and along the coast of Oregon there are relatively numerous recoveries. There are scattered recoveries south as far as San Francisco Bay and one even from the interior of southern California at Lancaster.

There are three indirect fall recoveries of birds banded on the Oregon coast far to the eastward; in one case even to the Atlantic seaboard. These records are: Unsexed bird banded Jan. 8, 1940 at Lake Lytle, Oregon, and recovered Oct. 20, 1941 at Mecox Bay, Long Island, N.Y.; female banded Jan 16, 1937 at Nehalem Bay, Oregon, and recovered Oct. 21, 1938 at Sandpoint, Idaho; female banded Dec. 9, 1934 at Lake Lytle, Oregon, and recovered Nov. 1, 1936 at Kimberley, British Columbia.

Eastern populations.--Information concerning the movements of the greater scaups which winter along the Atlantic seaboard and Gulf coast is derived chiefly from the results of banding on the lower Cooper River near Moncks Corner, Cordesville, and Bonneau Ferry in South Carolina. This is supplemented by banding on Lake Ontario and on the Finger Lakes in central New York State; also banding at Avery Island, La., near the Gulf coast.

It is obvious from a study of the map that the fall migrants of the eastern wintering population are first picked up in significant numbers when they reach the region just to the west of the Great Lakes, on the lakes of Minnesota and Wisconsin. What portions of the breeding range supply this population and how the ducks get from the breeding grounds to the northern United States is not clear from the banding records. Field observers are in agreement that the greater scaup is a rare migrant in the prairie provinces of Canada. Also, the recovery of only one South Carolina banded bird in Saskatchewan and one in Manitoba indicates that the main migration is not through the settled portions of these provinces. Two indirect recoveries of greater scaups banded in central New York State and recovered on the Pacific coast are of interest but there is no way of knowing what route these birds followed. The records are: Female banded at Union Springs, Cayuga Lake, New York, Feb. 27, 1923, and recovered at Big Lake, near Puget Sound, Washington, reported in a letter dated Dec. 7, 1927; male banded at Ithaca, New York, Feb. 7, 1939, and recovered at Port Simpson, near the coast of northwestern British Columbia, March 13, 1943.

Concentrations of recoveries in Minnesota and southeastern Ontario, particularly along the north shore of Lake Ontario, indicate that southward migrating greater scaups, which winter in the eastern part of the country, first reach settled country in these sectors from some unknown part of the breeding range and by some unknown route. Having reached the Great Lakes region the majority of the greater scaups apparently proceed to the Atlantic coast by way of the chain of Great Lakes, the



MAP 1. MIGRATIONAL MOVEMENT OF GREATER SCAUP BASED ON ALL RECOVERIES OF BIRDS BANDED. (HEAVY BLACK LINE INDICATES BREEDING AREAS)

LECEND

- BANDED AT MONCKS CORNERS AND CORDESVILLE, SOUTH CAROLINA.
- BANDED AT NEHALEM, MOHLER, LAKE LYTLE AND TILLAMOOK BAY, OREGON.
- BANDED AT AVERY ISLAND, LOUISIANA.
- BANDED AT TORONTO AND LAKE SCUGOC, ONTARIO; HENDERSON HARBOR, ITHACA AND UNION SPRINGS, NEW YORK.

New York Finger Lakes and the Hudson and Susquehanna Valleys.

There are a considerable number of records which indicate that many of the birds which winter in South Carolina first reach the Atlantic seaboard at Chesapeake Bay. There are a number of indirect fall recoveries of South Carolina banded birds from the vicinity of the Mississippi Delta, but the direction in which these birds have traveled cannot be determined. The single direct recovery on the Mississippi Delta in Terrebonne Parish, Louisiana, of a South Carolina-banded bird, indicates that the relatively few greater scaups which do winter on the Gulf Coast may reach there by way of the Atlantic coast. However, the fact that none of the birds banded at Avery Island, Louisiana, has been recovered on the Atlantic coast does not supply evidence for such a route. On the other hand, the paucity of recoveries of these birds in the Mississippi Valley, between the Gulf and the Great Lakes region, does not supply much evidence for a Mississippi route either.

The greatest wintering concentration of greater scaups on the Atlantic seaboard is probably on the bays and sounds of the New England States. How these birds get there from the breeding grounds is likewise not entirely clear. A single direct recovery of a duck banded at Henderson Harbor at the eastern end of Lake Ontario, taken in December at Stratford, Connecticut, indicates that at least part of the New England birds arrive from the northwestern breeding grounds via the Great Lakes and thence overland from Lake Ontario. It is very doubtful if the small breeding population in the Gulf of St. Lawrence region could supply a very large percentage of the great rafts of birds which winter in New England. Banding of this population on its wintering grounds is greatly needed. Banding of greater scaups anywhere on their breeding grounds would be of great value in shedding light on the little-known migration of this species.

MIGRATION OF THE LESSER SCAUP DUCK

By John W. Aldrich

Range

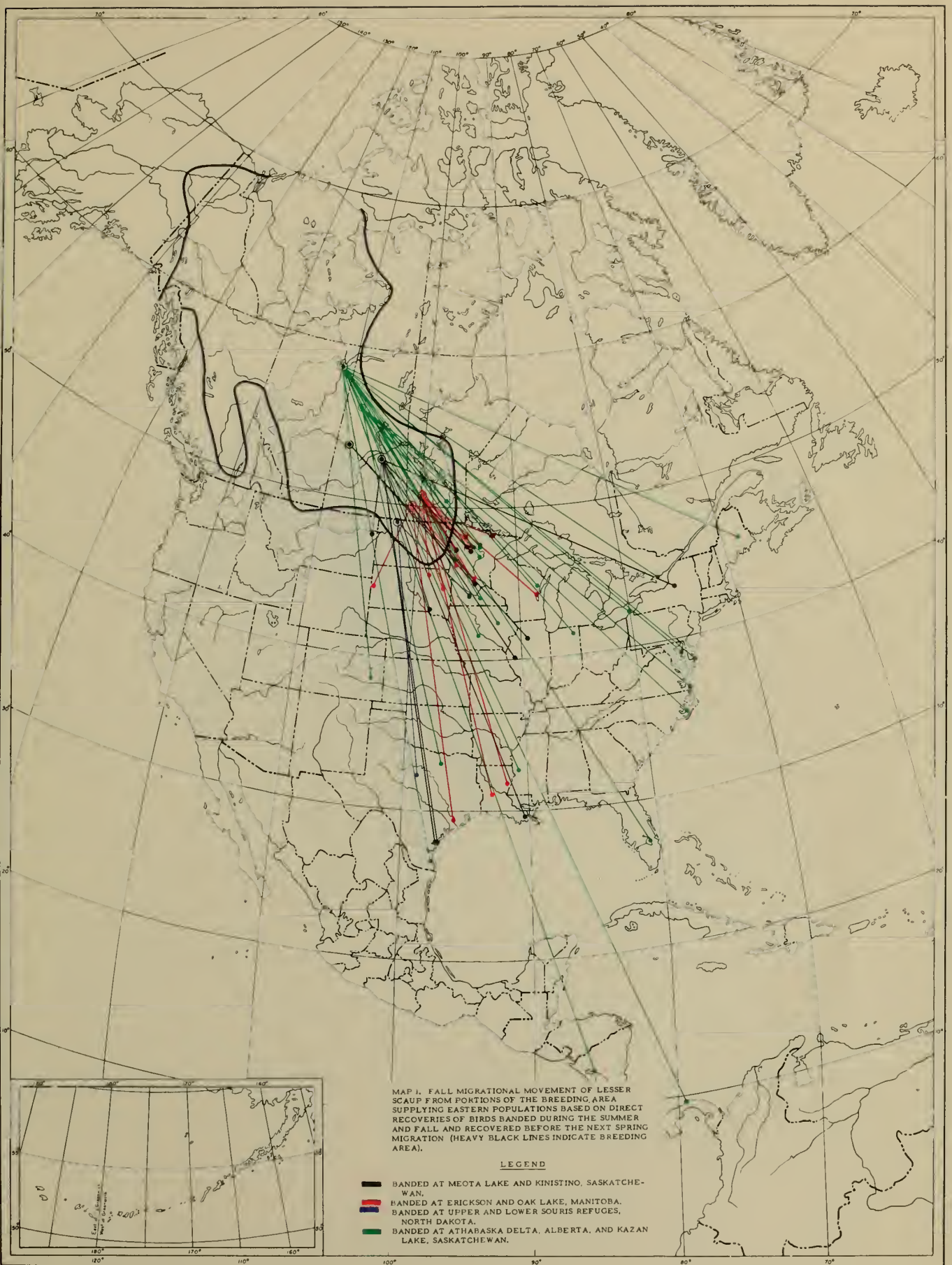
The breeding range indicated in the accompanying maps for the lesser scaup duck is based on published information. It is probably fairly accurate as to the limits of the southern portions. However, because of the difficulty of distinguishing this species from the greater scaup, the northern portions, particularly those which are shown to overlap the breeding range of the larger species are subject to considerable question. Up to the present time all of the breeding ground banding has been restricted to the more southern portions of the range where the greater scaup does not breed and, according to qualified field observers, is even a very rare migrant.

The winter range of the lesser scaup is very widespread, wherever there is open water, from the Atlantic to the Pacific and south to Panama. It does not require the larger and deeper bodies of water to the extent that the greater scaup does and, therefore, winters inland much more frequently.

Migration

There have been 43,037 lesser scaups banded, and this study is based on 1,683 of the recoveries from these bandings, including all recoveries of birds banded on their breeding grounds and all birds banded on wintering grounds in Florida, and the Pacific Coast States.

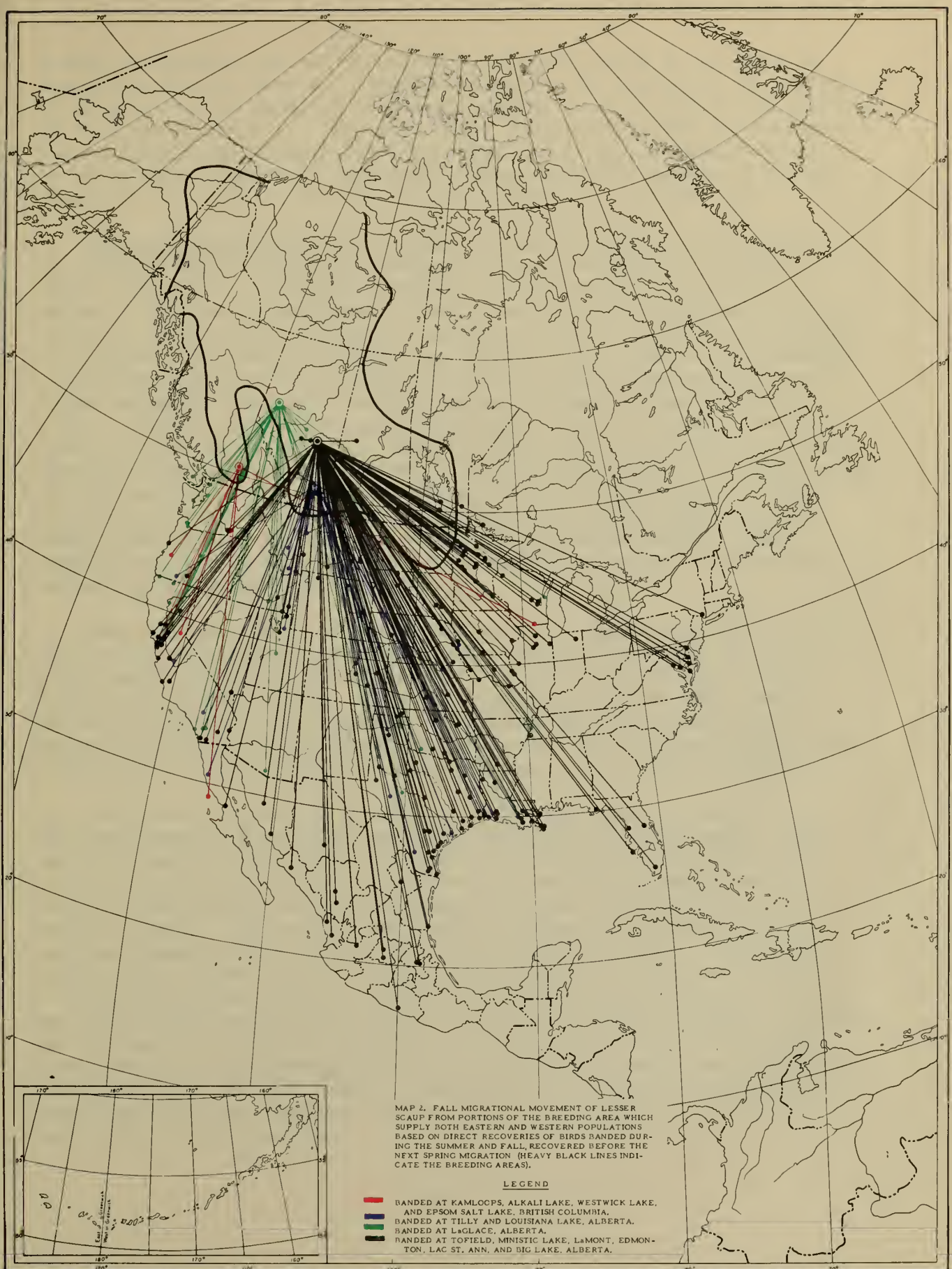
Southward migration from the more southern portions of the breeding range (although not necessarily breeding birds) is shown by the direct recoveries of birds banded in summer (Table 1) and early fall at 11 different stations in western Canada and the northern plains portion of the United States (Maps 1 and 2). A very large percentage of these birds were young when banded and probably near their place of hatching. The data do not indicate any difference in the migration patterns of birds of different ages or sexes (Table 1) nor between those banded in the summer (before Sept. 1) or fall (between Sept. 1 and the middle of October). There is, however, a marked difference in migration pattern between populations banded in different parts of the breeding area. With only one exception, all birds banded in the region extending from northeastern Alberta (Athabaska Delta) and central western Saskatchewan eastward were recovered in a southeasterly direction from the point of banding (see Map 1). From this region 99.5 percent of the 18 summer-banded recoveries were southeast of the point of banding (Table 1). Those



MAP 1. FALL MIGRATIONAL MOVEMENT OF LESSER SCAUP FROM PORTIONS OF THE BREEDING AREA SUPPLYING EASTERN POPULATIONS BASED ON DIRECT RECOVERIES OF BIRDS BANDED DURING THE SUMMER AND FALL AND RECOVERED BEFORE THE NEXT SPRING MIGRATION (HEAVY BLACK LINES INDICATE BREEDING AREA).

LEGEND

- BANDED AT MEOTA LAKE AND KINISTINO, SASKATCHEWAN.
- BANDED AT ERICKSON AND OAK LAKE, MANITOBA.
- BANDED AT UPPER AND LOWER SOURIS REFUGES, NORTH DAKOTA.
- BANDED AT ATHABASKA DELTA, ALBERTA, AND KAZAN LAKE, SASKATCHEWAN.



MAP 2. FALL MIGRATIONAL MOVEMENT OF LESSER SCAUP FROM PORTIONS OF THE BREEDING AREA WHICH SUPPLY BOTH EASTERN AND WESTERN POPULATIONS BASED ON DIRECT RECOVERIES OF BIRDS BANDED DURING THE SUMMER AND FALL, RECOVERED BEFORE THE NEXT SPRING MIGRATION (HEAVY BLACK LINES INDICATE THE BREEDING AREAS).

LEGEND

- BANDED AT KAMLOOPS, ALKALI LAKE, WESTWICK LAKE, AND EPSOM SALT LAKE, BRITISH COLUMBIA.
- BANDED AT TILLY AND LOUISIANA LAKE, ALBERTA.
- BANDED AT LaGLACE, ALBERTA.
- BANDED AT TOFIELD, MINISTIC LAKE, LaMONT, EDMONTON, LAC ST. ANN, AND BIG LAKE, ALBERTA.

banded in southern and western Alberta, at least north to La Glace in the Grande Prairie Section, migrated either to the southeast (62 percent of breeding season bandings in Alberta, Table 1) or southwest (38 percent of this group, Table 1). It would seem, then, that lesser scaups from the southern part of their breeding range may be considered as belonging to two distinct groups of populations based on the direction of their migration to either eastern or western wintering grounds.

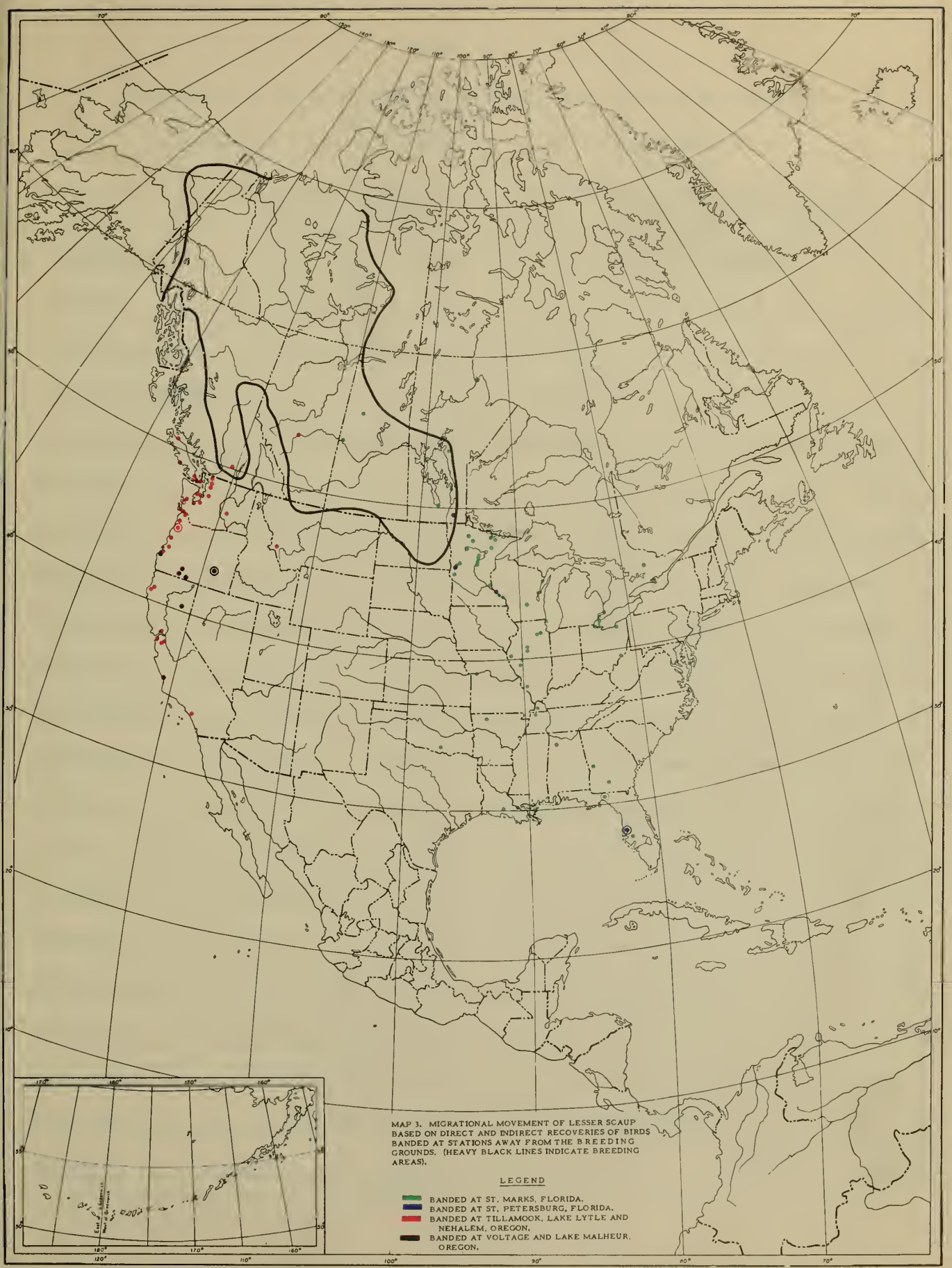
Eastern populations.--This group is derived from breeding areas as far west as western Alberta, overlapping the breeding range of the western group. The eastward movement of one bird from the interior valley of British Columbia may indicate an even further westward distribution of this group. The ducks belonging to these populations migrate in a general southeasterly direction chiefly via the Central and Mississippi Flyways toward the Gulf coast. Some of them move southeasterward to Minnesota and Wisconsin before turning southward toward the Gulf coast. A smaller group evidently continues on via the Great Lakes and river pathways to the Atlantic seaboard where representatives are found chiefly in the Chesapeake Bay area. A big majority of the lesser scaups of this section of the eastern population do not migrate east of Lake Michigan and the Illinois River but apparently turn southward along these thoroughfares to the Mississippi and thence to the Gulf coast. Further analysis of banding recoveries will be necessary to determine definitely the pathway of this movement.

The greatest wintering concentration of all seems to occur from the delta of the Mississippi, southwestward to the mouth of the Rio Grande. A few recoveries from this population have been obtained southward in Mexico and Central America. However, it should be noted that none of the birds banded in the areas east of Alberta have been recovered in Mexico. It is of interest that the two Central American recoveries were both from the most northerly banding station, on the Athabaska Delta.

The Florida wintering population of lesser scaups is apparently derived primarily from birds using the Mississippi Valley route, judging from indirect recoveries of birds banded in Florida (Map 3). However, this same map indicates that part of the Florida group reaches there by the Great Lakes to Chesapeake Bay route and thence down the Atlantic coast. The scarcity of recoveries from the Atlantic seaboard between Chesapeake Bay and Florida is surprising, however. The northward migration from Florida in the spring apparently, in part at least, is by a more direct overland route as indicated by spring recoveries of St. Marks Refuge-banded birds (Map 3) in the interior of Georgia, Alabama, and southern Ohio, whereas there are no fall recoveries of this population between the Mississippi River and the Atlantic coast and between the Great Lakes and the Gulf coast. Data based on bandings of lesser scaups wintering in the southeastern states north of Florida and in Louisiana have not yet been studied.

Western populations.--This group breeds in southern British Columbia and in southern and western Alberta. Judging from the recoveries shown on Map 2, the birds migrate in a southwesterly direction toward the Pacific Coast. The chief route from Alberta appears to be through western Montana and by way of the Snake River valley of southern Idaho. A few are recovered in the Great Salt Lake Region of northern Utah. Representatives of this group appear in the interior valleys of California and the vicinity of the coast where they are recovered chiefly in the San Francisco Bay and San Diego areas. Some birds from western Alberta apparently cross the mountains westward into British Columbia, and proceed southwestward to the Puget Sound area and join other segments of the western group in the vicinity of the coast of Oregon and California (see Map 2). How the majority of lesser scaups reach western Mexico is not certain but two possibilities present themselves; down the coast from California or directly south through the Great Basin and southwestern desert country.

Map 3, showing the recovery of birds banded in the Pacific Flyway, substantiates the routes of southward movement of the western group described above, but adds nothing to the information on distribution in addition to that shown by breeding-ground banding. A single record of a bird recorded as a lesser scaup, banded on the coast of Oregon and recovered at Carter Bay on the western coast of Alaska, far to the west of the known breeding grounds of the species, has been rejected as probably a misidentification.



MAP 3. MIGRATIONAL MOVEMENT OF LESSER SCAUP BASED ON DIRECT AND INDIRECT RECOVERIES OF BIRDS BANDED AT STATIONS AWAY FROM THE BREEDING GROUNDS. (HEAVY BLACK LINES INDICATE BREEDING AREAS).

LEGEND

- BANDED AT ST. MARKS, FLORIDA.
- BANDED AT ST. PETERSBURG, FLORIDA.
- BANDED AT TILLAMOOK, LAKE LYTLE AND NEHALEM, OREGON.
- BANDED AT VOLTAGE AND LAKE MALHEUR, OREGON.

TABLE I

Recoveries of Breeding Season* Banded Lesser Scaups by States

(Banded as juvenals unless indicated by A as adult)

	Banded							
Recovered	Alberta except Athabaska Delta	%	Brit. Columbia	%	Manitoba	%	Saskatchewan incl. Athabaska Delta	%
Alberta	1 A ♂, 23♂ 24 ♀, 12-	25					1 ♂	6.7
Baja California	♂, A ♀	1	1-	7.7				
British Columbia			3-	23.0				
California	1 A ♂, 1 A ♀ 3 ♂, 3 ♀, 19-	15	1 A ♂ 1 ♀, 5-	53.8				
Chihuahua	1-	0.5	1 A ♀	7.7				
Colorado	1 ♂, 4-	3					1-	6.7
Durango	1-	0.5						
Florida	2-	1			1 ♀ 1-	22.2		
Georgia	1-	0.5						
Guanajuato	1-	0.5						
Guerrero	A ♂	0.5						
Hidalgo	1-	0.5						
Idaho	1 ♂, 2 ♀, 1-	2						
Illinois	1 ♀, 3-	2					1 ♀	6.7
Indiana	1-	0.5						
Iowa	4-, 1A ♂	3					1-	6.7
Kansas	1 ♂, 1 ♀, 5-	4						
Louisiana	1 A ♂, 1 A ♀ 2 ♂, 2 ♀, 5-	6						
Manitoba	1 ♂, 1 ♀, 5-	4			1 A ♀	22.2		
Maryland	3-	1.5					1 A ♀	6.7

* Banded between June 15 and August 31.

TABLE I (Contd.)

	Banded							
Recovered	Alberta except Athabaska Delta	%	Brit.Columbia	%	Manitoba	%	Saskatchewan incl. Athabaska Delta	%
Michigan	A ♀	0.5						
Minnesota	1 ♀ 12-, 2A ♂	8			1 A ♂ 1 A ♀	22.2	2-	13.3
Missouri	5-	3			1 ♂	11.1		
Montana	3 ♂,3 ♀, 4-	5.5					1 ♂	6.7
Nayarit	1-	0.5						
Nebraska	1 ♀, 2-	1.5						
Nevada	1-	0.5						
New York	1-	0.5						
North Dakota					1 A ♂	11.1		
Oklahoma	1 ♂,2 ♀, 6-	5						
Ontario	1 ♂, 1-	1						
Oregon	1 ♀	0.5	1-	7.7				
Saskatchewan	1 ♀, 3-	2					1 ♂, 1-	13.3
Sinaloa	A ♀	0.5						
Sonora	2-	1						
South Dakota	3-	1.5			1A ♀	11.1	1 ♂	6.7
Tamaulipas	1-	0.5						
Texas	2 A ♀, 15- 5 ♂, 5 ♀	15					1 ♀ 1 ♂, 1 A-	20.0
Utah	1 ♂, 1 ♀, 1-	1.5						
Virgihia							1-	6.7
Wisconsin	2 A ♂	1						
Wyoming	1 ♂, 1 ♀	1						

MIGRATION OF THE RUDDY DUCK

By Allen G. Smith

Most of the ruddy duck banding took place during the 8-year period (1930-1938) but so few have been banded that the total recoveries to date number only 32. Of these 21, or 65%, are direct recoveries from birds banded on the breeding grounds or in fall migration. Banding locations were widely scattered from California on the west to central Alberta, southern Saskatchewan, Manitoba, and southeastern Ontario on the north, and Louisiana and Texas on the south. The direct recoveries were evenly scattered, and so few in number that any attempt to interpret these data would be open to question. Thus any migration study of the ruddy duck by this method must await more recoveries based on extensive banding of this species.

The accompanying map shows the place of banding and recovery for all direct recoveries away from the vicinity of banding, while the following table lists all recoveries by state or province of banding.

Direct Recoveries of Ruddy Duck
Banded during summer or fall

Place of Banding	Place of Recovery	
California	California	(2)
Utah	California	(1)
"	Nevada	(1)
Alberta	Montana	(1)
"	Arizona	(1)
"	Alberta	(1)
Saskatchewan	Mexico	(1)
Manitoba	Manitoba	(2)
Texas	Texas	(1)
Minnesota	Louisiana	(1)
"	Ontario	(1)
Wisconsin	Wisconsin	(1)
"	New York	(1)
"	Maryland	(1)
"	Ohio	(1)
"	Tennessee	(1)
Michigan	Michigan	(1)
Louisiana	Louisiana	(2)
Ontario	Ontario	(1)

Indirect Recoveries of Ruddy Duck
Banded during summer or fall

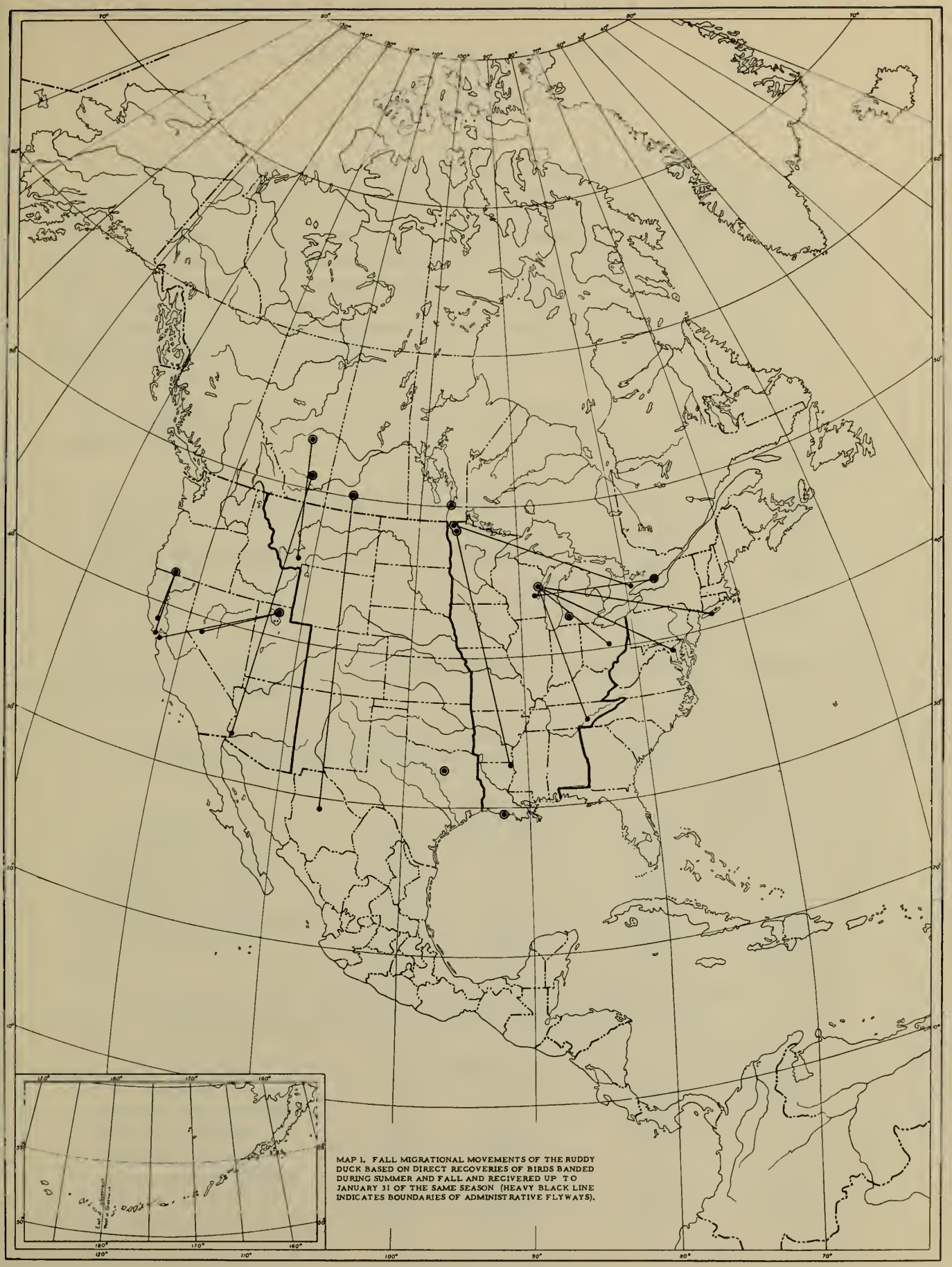
Place of Banding	Place of Recovery	
California	California	(1)
Oregon	Saskatchewan	(1)
Louisiana	Louisiana	(1)
"	Saskatchewan	(1)
Manitoba	North Dakota	(1)

Direct Recoveries of Ruddy Duck
Banded in winter or spring

Place of Banding	Place of Recovery	
California	California	(1)
Oregon	Oregon	(1)

Indirect Recoveries of Ruddy Duck
Banded in winter or spring

Place of Banding	Place of Recovery	
California	California	(3)
Wisconsin	Wisconsin	(1)



MAP 1. FALL MIGRATIONAL MOVEMENTS OF THE RUDDY DUCK BASED ON DIRECT RECOVERIES OF BIRDS BANDED DURING SUMMER AND FALL AND RECIVERED UP TO JANUARY 31 OF THE SAME SEASON (HEAVY BLACK LINE INDICATES BOUNDARIES OF ADMINISTRATIVE FLYWAYS).

MIGRATION OF THE CANADA GOOSE

By G. Hortin Jensen

The Canada goose has an extensive range from coast to coast on the North American continent. It breeds as far north as 62 degrees north latitude south to around 40 degrees north latitude in the western States. It winters somewhat south of this to approximately 27 degrees north latitude. Over much of this range Canada geese have been banded. A partial analysis of these band recoveries has been made. Banding in the west has usually been done on breeding populations, while those of the east have been banded on the wintering grounds (see tabulations below). The breeding grounds of the eastern flocks, for the most part, are more inaccessible than those of the west.

The analysis of 3,024 recoveries of banded Canada geese gives the following tabulation:

	No. of Recoveries	Percent
Direct Recoveries of Summer and Fall Banding	1,005	32.2
Indirect " " " " " "	1,175	38.9
Direct Recoveries of Winter and Spring "	106	3.5
Indirect " " " " " "	738	24.4
Total	3,024	100.0

These recoveries have been broken down by administrative flyways. This analysis follows:

Direct Recoveries of Canada Geese Banded in Summer and Fall, showing region of banding and region of recovery.

	Banded		Recovered	
Region	No.	Percent	No.	Percent
Canada and Alaska	95	9.4	75	7.5
Pacific Flyway	680	67.7	696	69.2
Central Flyway	27	2.7	30	3.0
Mississippi Flyway	186	18.5	187	18.6
Atlantic Flyway	17	1.7	17	1.7
Total	1,005	100.0	1,005	100.0

Indirect Recoveries of Canada Geese Banded in Summer and Fall, showing region of banding and region of recovery.

	Banded		Recovered	
Region	No.	Percent	No.	Percent
Canada and Alaska	27	2.3	181	15.4
Pacific Flyway	624	53.1	600	51.1
Central Flyway	30	2.5	40	3.4
Mississippi Flyway	465	39.6	315	26.8
Atlantic Flyway	29	2.5	39	3.3
Total	1,175	100.0	1,175	100.0

Direct Recoveries of Canada Geese banded in Winter and Spring

	Banded		Recovered	
	No.	Percent	No.	Percent
Canada and Alaska	4	3.8	64	60.4
Pacific Flyway	1	0.9	0	0.0
Central Flyway	1	0.9	1	0.9
Mississippi Flyway	54	51.0	23	21.7
Atlantic Flyway	46	43.4	18	17.0
Total	106	100.0	106	100.0

Indirect Recoveries of Canada Geese banded in Winter and Spring

	Banded		Recovered	
	No.	Percent	No.	Percent
Canada and Alaska	17	2.3	233	31.6
Pacific Flyway	19	2.6	19	2.6
Central Flyway	7	0.9	9	1.2
Mississippi Flyway	307	41.6	233	31.6
Atlantic Flyway	388	52.6	244	33.0
Total	738	100.0	738	100.0

While the Canada goose has a large over-all range, its migrations are not necessarily equally broad. Quite definite patterns are found for particular flocks (see Map 1). These flights are best outlined by direct recoveries from the breeding and wintering grounds. For example, in the Pacific Flyway we know of three defined migratory routes as follows:

1. Breeding flocks of eastern Oregon and northern California migrate to central valleys of California.

2. Breeding flocks of Lake Newell and Bassano Dam, Alberta migrate through Montana and Idaho and winter in western Nevada and eastern California around Mono Lake.

3. Breeding flocks of intermountain areas of western Montana, eastern Idaho, and northern Utah migrate through these States and winter in southern Utah and the lower Colorado River area of Arizona and California.

To more completely outline the goose flyways, we need to have more banding on the breeding grounds. From the direct returns from these bandings, we will get the positive information needed. This type of data is especially needed for the Central Flyway, but breeding flocks in all flyways that have not been banded should receive attention.

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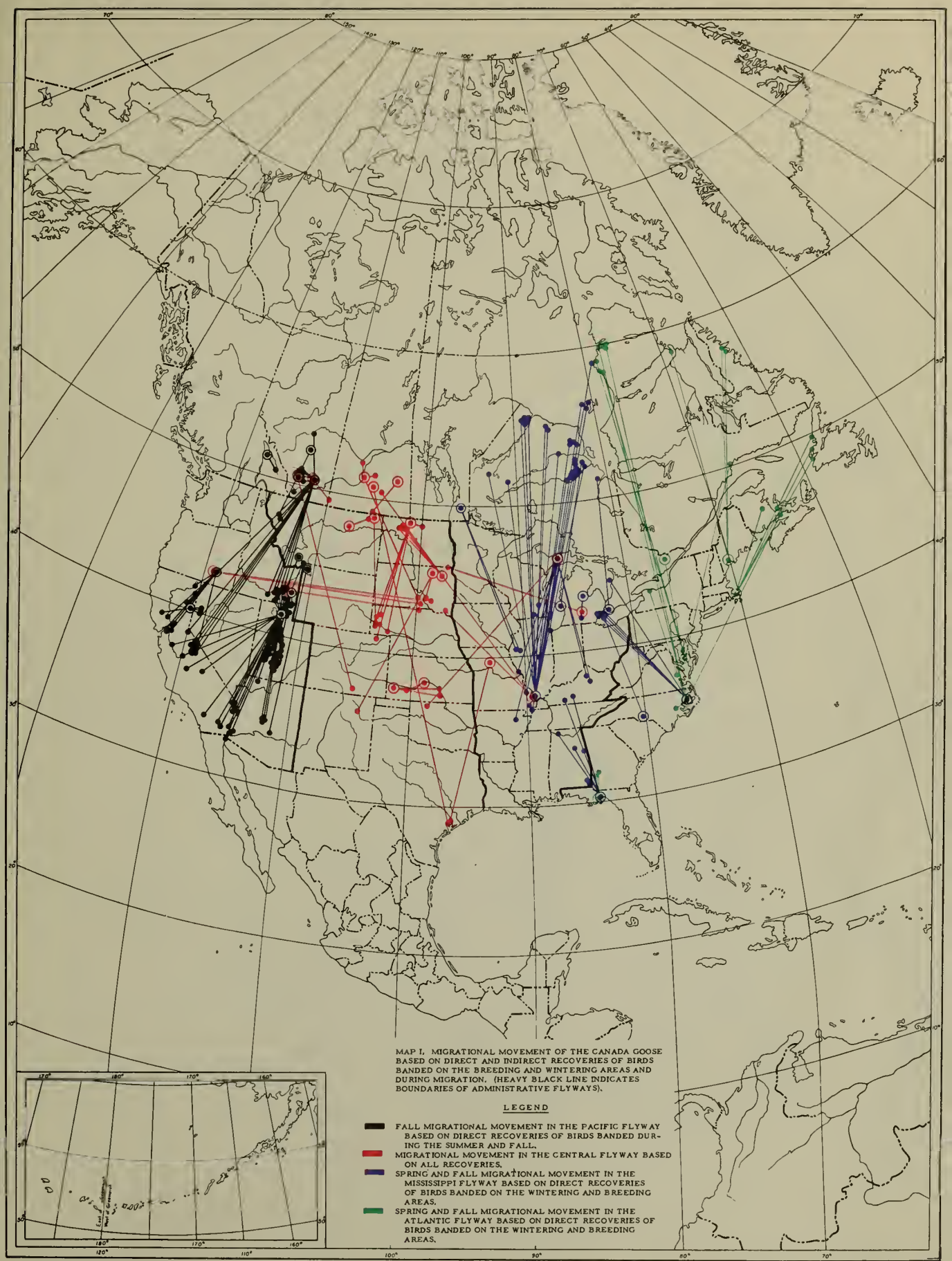

MAP I. MIGRATIONAL MOVEMENT OF THE CANADA GOOSE BASED ON DIRECT AND INDIRECT RECOVERIES OF BIRDS BANDED ON THE BREEDING AND WINTERING AREAS AND DURING MIGRATION. (HEAVY BLACK LINE INDICATES BOUNDARIES OF ADMINISTRATIVE FLYWAYS).

LEGEND

- FALL MIGRATIONAL MOVEMENT IN THE PACIFIC FLYWAY BASED ON DIRECT RECOVERIES OF BIRDS BANDED DURING THE SUMMER AND FALL.
- MIGRATIONAL MOVEMENT IN THE CENTRAL FLYWAY BASED ON ALL RECOVERIES.
- SPRING AND FALL MIGRATIONAL MOVEMENT IN THE MISSISSIPPI FLYWAY BASED ON DIRECT RECOVERIES OF BIRDS BANDED ON THE WINTERING AND BREEDING AREAS.
- SPRING AND FALL MIGRATIONAL MOVEMENT IN THE ATLANTIC FLYWAY BASED ON DIRECT RECOVERIES OF BIRDS BANDED ON THE WINTERING AND BREEDING AREAS.